Monetary Policy, Inflation, and Crises: Evidence from History and Administrative Data

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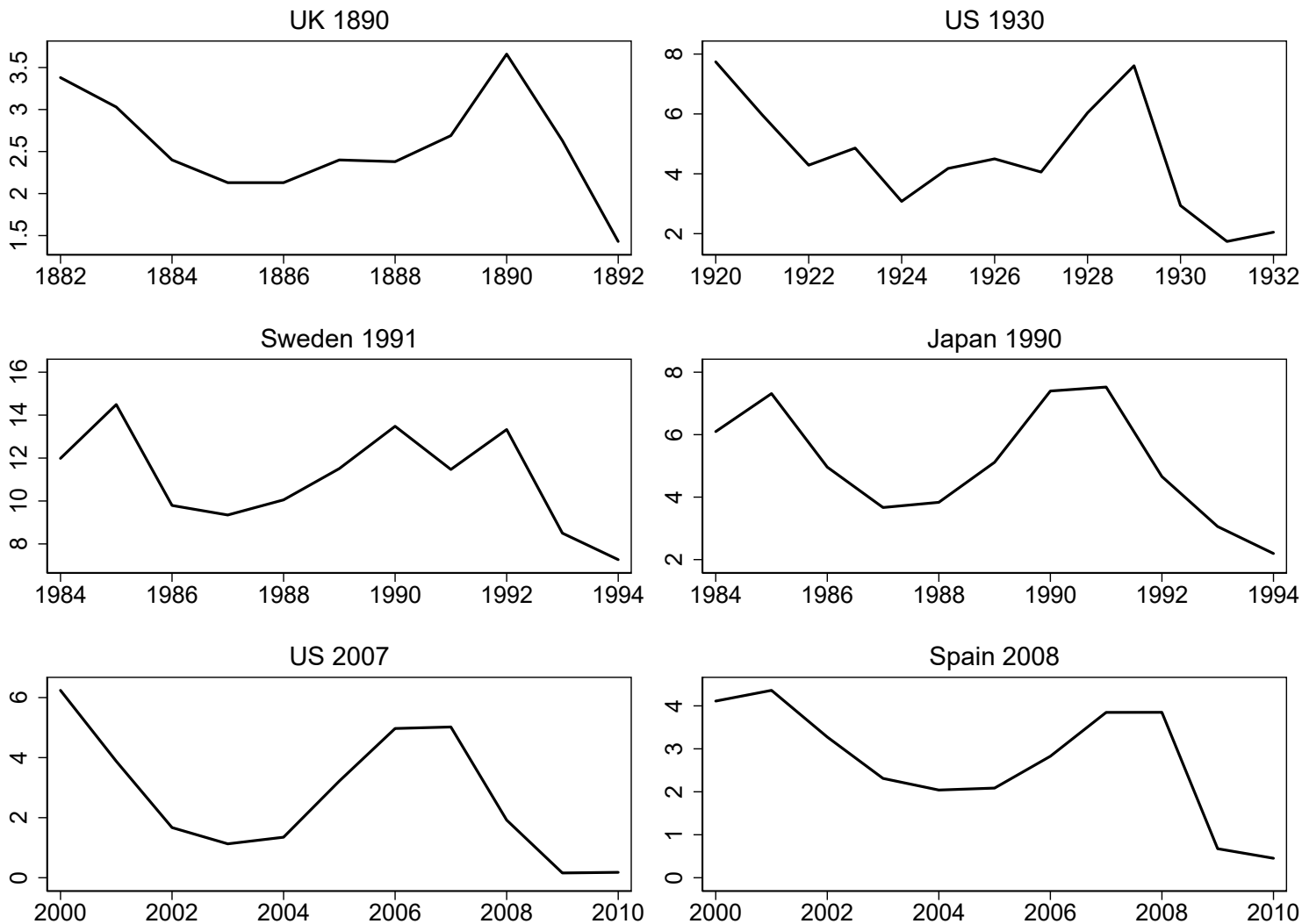
Motivation

- Post-pandemic environment: high inflation, rising policy rates
- Policymakers are balancing risks of inflation vs recession
  - We know a lot about these inflation–GDP trade-offs (Blinder, 2023)
- But raising rates can also trigger a financial crisis (2022-23 financial distress: SVB & other banks, sovereign EA, UK pension funds / Gilts, crypto, CRE, private credit...)
  - Especially after a period of low rates (Acharya et al., 2022; Kashyap and Stein, 2023; IMF, 2023; ECB, 2023; Rajan, 2023)
- **We know little about the links between the path of monetary policy and banking crises**

Case studies of important banking crises



y axis: nominal monetary policy rate

This paper

- **Impact of monetary policy (MP) dynamics on banking crises**
  - What is the full path of the MP rate before a crisis?
  - Does raising rates in an environment like today (U-shaped path) increase crisis risk?
  - What are the underlying mechanisms?
- **Data: two-pronged approach**
  - A panel of historical crises to establish the results & mechanisms (17 countries, 1870–2016, 80 crises)
  - Credit registry data for detailed crisis case study (Spain, 1995–2020)
- MP rate: short-term nominal rate (raw or relative to GDP and inflation dynamics); international finance trilemma IV

Findings

1. **U-shaped monetary policy (MP) rate path increases crisis risk**
   - Most banking crises preceded by a U in MP rates
   - Raising MP rates materially increases crisis risk, but only if rates were previously cut over a long period
   - **Different for non-crisis recessions**. Stronger for deeper U.

Findings

1. **U-shaped monetary policy (MP) rate path increases crisis risk**
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   - Raising MP rates materially increases crisis risk, but only if rates were previously cut over a long period
   - **Different for non-crisis recessions**. Stronger for deeper U.

2. **Mechanism**: higher credit & asset prices as MP rates are cut (first half of the U), larger reversal if raises follow such cut
   - Red-zone (R-zone) booms (Greenwood et al., 2022) after (strong) MP rate cuts
   - Higher crisis risk within R-zone only if MP rate hikes
   - Combination of **U-MP & R-zone crucial for crises**
   - Boom-bust in **bank performance** around U-MP & R-zones
   - **Microdata**: loan defaults higher after U-MP, especially for ex-ante riskier firms & banks

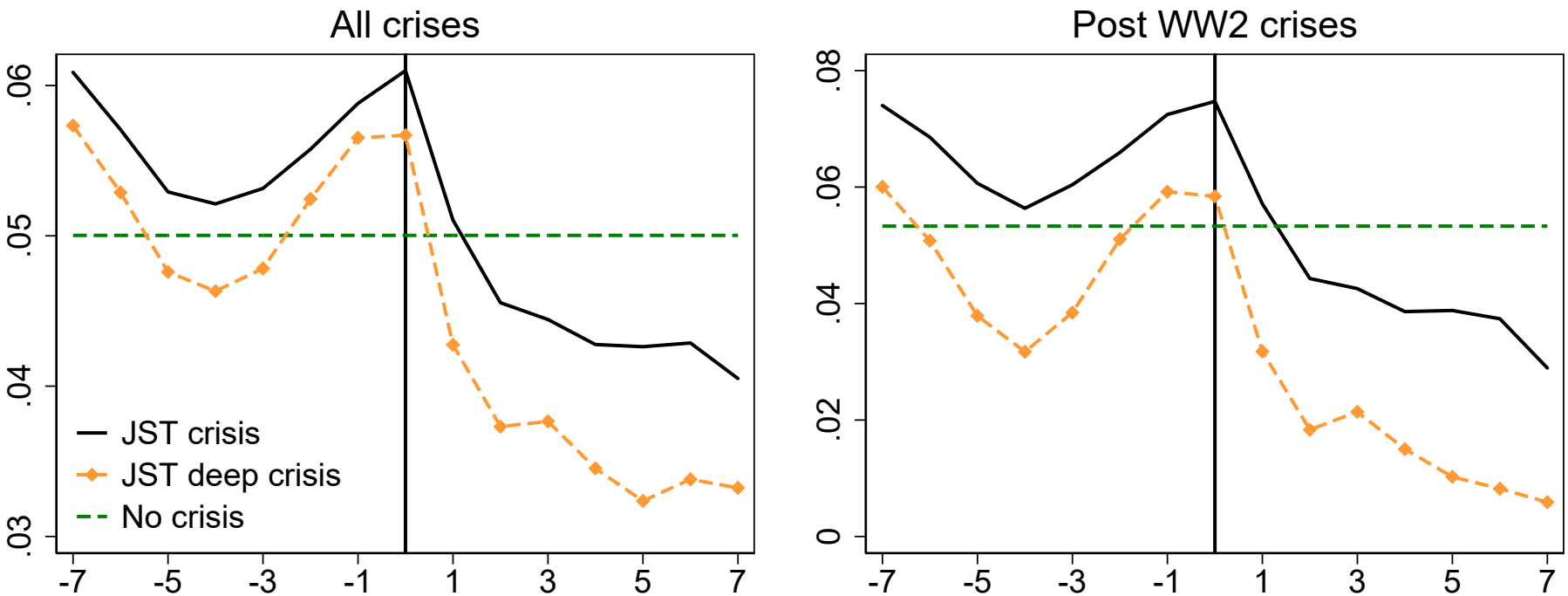
▸ Literature

The path of monetary policy rates and crisis risk

Data

- 17 advanced economies (13 European countries, USA, Canada, Australia, Japan), 1870–2016 (Jordà et al., 2016)
- Narrative crisis definition (Schularick and Taylor, 2012) (bank runs / defaults / forced mergers)
  - Robust to Baron et al. (2021) chronology: narrative + sharp declines in bank stock returns
- Monetary policy rate: short-term interest rate (central bank / interbank / t-bill rate)

Monetary policy rates around crises

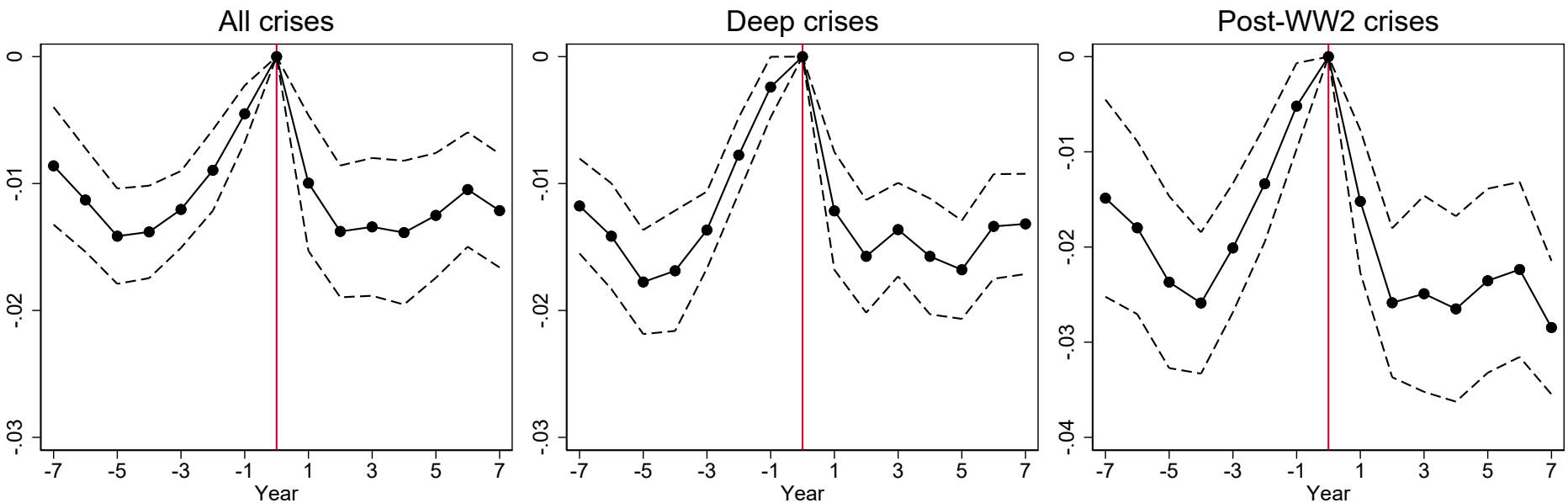


Crisis definitions. JST: Jordà et al. (2016); JST deep: JST & low GDP growth

▸ Inflation & real rates

Monetary policy rates: Crisis window regressions

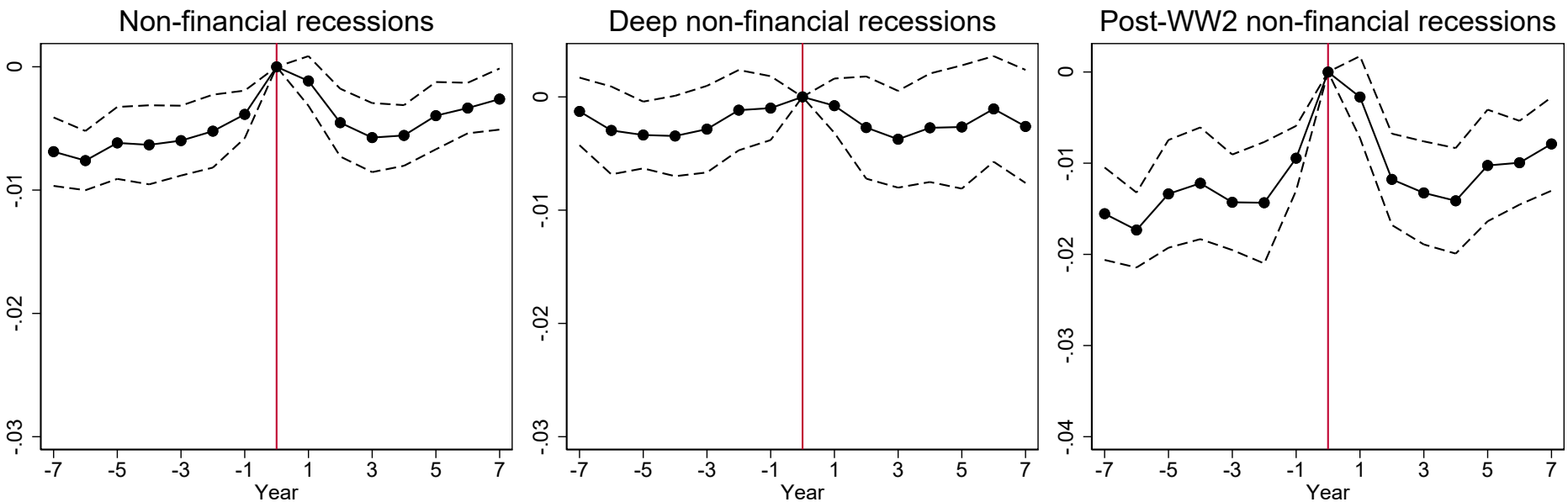
$$r_{i,t+h} - r_{i,t} = \alpha_{i,h} + \alpha_{d,h} + \beta_h \mathbb{1}_{Crisis_{i,t}=1} + \epsilon_{i,t+h} \quad h \in \{-7, ..., 7\}.$$



▸ Residual rates ▸ Long-term rates

Monetary policy rates & non-financial recessions

$$r_{i,t+h} - r_{i,t} = \alpha_{i,h} + \alpha_{d,h} + \beta_h \mathbb{1}_{\text{Recession}_{i,t}=1} + \epsilon_{i,t+h} \quad h \in \{-7, ..., 7\}.$$



Frequency of MP paths before crises & recessions

- Sort data in 2×2 groups by time window (t – 8 to t – 3 & t – 3 to t) and monetary rate change (cut vs raise)
- 55% of crises are preceded by a U in full sample; 71% post WW2
- By contrast, only $\approx 30\%$ of recessions preceded by U ▸ Graphs

	(1) All	(2) Deep	(3) Post-WW2	(4) Post-WW2 deep	(5) Unconditional
			Panel A: Banking crises		
U shape (cut, raise)	0.55***	0.63***	0.71***	1.00***	0.27
Raise, raise	0.19	0.16	0.12	0.00	0.24
Raise, cut	0.16	0.11	0.08	0.00	0.26
Cut, cut	0.10	0.11	0.08	0.00	0.23
			Panel B: Non-financial recessions		
U shape (cut, raise)	0.34**	0.30	0.31	0.31	0.27
Raise, raise	0.21	0.21	0.29	0.46**	0.24
Raise, cut	0.25	0.21	0.26	0.15	0.26
Cut, cut	0.20	0.28*	0.14	0.08	0.23

*: higher frequency than non-crisis obs

Frequency of crises after different MP rate paths

- Compute crisis frequency 3 years after each shape (t to t + 2)
- Crises are more than twice as frequent after the U shape than after other shapes

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
U shape (cut, raise)	0.18***	0.11***	0.16***	0.13***
Raise, raise	0.09	0.04	0.04	0.01
Raise, cut	0.06	0.02	0.02	0.00
Cut, cut	0.06	0.03	0.03	0.00
Unconditional	0.10	0.05	0.06	0.03

*: higher frequency than other bins

▸ With numbers of crises ▸ 1-year crisis window ▸ Symmetric U ▸ Non-financial recessions

Trilemma instrument

- Countries with fixed exchange rate and open capital accounts are forced to track base country interest rates (Mundell, 1963)
- Use base country interest rate changes to look at exogenous policy responses (Jordà et al., 2020, see also Maddaloni and Peydro, 2011; Jiménez et al., 2012, 2014)

$$\text{Trilemma IV} = \Delta \text{Rate}^{\text{Residual}}_{b(i),t} * \text{PEG}_{i,t} * \text{PEG}_{i,t-1} * \text{KOPEN}_{i,t}.$$

- $\text{Rate}^{\text{Residual}}_{b(i),t}$: change in the base country residual rate
  - Controls: inflation, GDP, consumption, investment, current account, short-term rates, long-term rates

U-shaped monetary policy rates and crises

$$\text{Crisis}_{i,t \text{ to } t+2} = \alpha_i + \beta_1 \Delta_3 \text{Rate}_{i,t} + \beta_2 \text{Cut}_{i,t-8,t-3} + \beta_3 \Delta_3 \text{Rate}_{i,t} \times \text{Cut}_{i,t-8,t-3} + \gamma X_{i,t} + u_{i,t}.$$

	Dependent variable: $\text{Crisis}_{t \text{ to } t+2}$							
	Full sample				Post-WW2			
	OLS		IV		OLS		IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 \text{Rate}_t$	0.02**	0.01	0.03	0.01	0.01	0.01	0.03	0.01
	(0.01)	(0.00)	(0.02)	(0.01)	(0.01)	(0.01)	(0.03)	(0.02)
$\text{Cut Rate}_{t-8,t-3}$		0.05		0.04		0.04		0.01
		(0.03)		(0.03)		(0.03)		(0.03)
$\Delta_3 \text{Rate}_t \times \text{Cut Rate}_{t-8,t-3}$		0.03**		0.07**		0.02**		0.08***
		(0.01)		(0.03)		(0.01)		(0.03)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID			45.41	26.57			54.27	24.34
Observations	1626	1626	1626	1626	951	951	951	951

$X_{i,t}$ contains 8 lags of yearly real GDP growth and inflation (country and sample average), and a crisis dummy. Driscoll-Kraay s.e. with 5 lags.

▸ Economic effects ▸ Excluding GFC ▸ BVX crises ▸ Probit

No U-shape effects for (deep) non-crisis recessions

	Normal recession$_{t \text{ to } t+2}$				Deep recession$_{t \text{ to } t+2}$	
	OLS		IV		OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 \text{Rate}_t$	0.02**	0.02**	0.05*	0.06*	0.01**	0.03
	(0.01)	(0.01)	(0.03)	(0.03)	(0.00)	(0.02)
Cut $\text{Rate}_{t-8,t-3}$		-0.05		-0.08**	-0.03	-0.05
		(0.03)		(0.04)	(0.02)	(0.03)
$\Delta_3 \text{Rate}_t \times$ Cut $\text{Rate}_{t-8,t-3}$		0.01		-0.00	-0.00	-0.01
		(0.01)		(0.04)	(0.01)	(0.02)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID			48.80	29.22		29.22
Observations	1626	1626	1626	1626	1626	1626

$X_{i,t}$ contains 8 lags of yearly real GDP growth and inflation (country and sample average), and recession dummy. Driscoll-Kraay s.e. with 5 lags.

Does the depth of the U matter?

1. Larger cuts and raises are associated with higher crisis risk

   ▸ 3 × 3, raw ▸ 3 × 3, residuals

2. Does cutting & raising "too much" increase crisis risk?

   - Analyse MP relative to macroeconomic developments
   - Systematic MP proxied by GDP and inflation, by country & period (pre-1914, interwar, Bretton-Woods, post-1973)

Strong vs moderate U-MP & crises

- Cutting and raising more than systematic component is linked to higher crisis risk ▸ Detailed ▸ Regressions

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
Strong U (residual cut & raise)	0.30***	0.21***	0.27***	0.23***
Moderate U (systematic cut or raise)	0.07	0.05	0.04	0.04
Raise, raise	0.08	0.03	0.04	0.00
Raise, cut	0.01	0.01	0.01	0.00
Cut, cut	0.05	0.02	0.02	0.00
Unconditional	0.09	0.05	0.06	0.04

*: higher frequency than other bins

▸ Summary / robustness

Understanding the mechanisms

Why does U-shaped policy increase crisis risk?

- Low rates create financial vulnerabilities (Jiménez et al., 2014; Acharya and Rajan, 2022; Kashyap and Stein, 2000)
- Rate increases may crystallize these vulnerabilities
- Define financial "red zone" (R-zone) as in Greenwood, Hanson, Shleifer, and Sørensen (2022)

$$\text{R-zone}_{i,j,t} = \text{High-Credit-Growth}_{i,j,t} * \text{High-Price-Growth}_{i,j,t}$$

$$\text{High-Cred.-Growth}_{i,j,t} = 1\left\{\Delta_3(\text{Credit/GDP})_{i,j,t} > 80^{\text{th}} \text{ percentile}\right\}$$

$$\text{High-Price-Growth}_{i,j,t} = 1\left\{\Delta_3 \ln(\text{Asset Price})_{i,j,t} > 66.7^{\text{th}} \text{ percentile}\right\}$$

Rate cuts increase the likelihood of future R-zones

- Monetary rate cuts increase the likelihood of ending up in the R-zone over the next 3 years ▸ Res. rates

	R-Zone Either$_{t+1 \text{ to } t+3}$					
	ΔRate$_{t-5,t}$		Cut Rate$_{t-5,t}$		Large Cut$_{t-5,t}$	
	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)
See header	-0.02***	-0.05***	0.07**	0.34**	0.09***	0.35***
	(0.01)	(0.02)	(0.04)	(0.15)	(0.03)	(0.13)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Kleibergen-Paap		43.48		54.67		26.98
Observations	1335	1335	1335	1335	1335	1335

- Also, in the boom: low credit spreads; high bank equity valuations; predictably worse future outcomes ▸ Details
  - Consistent with ↑ credit supply & overoptimism

Raising rates in the R-zone triggers crises

- (Strong) raises in the R-zone increase crisis risk

	Dependent variable: $\text{Crisis}_{t \text{ to } t+2}$					
	All raises			Residual raises		Systematic raises
	OLS (1)	OLS (2)	IV (3)	OLS (4)	IV (5)	OLS (6)
$\text{R-Zone}_{t-3 \text{ to } t-1}$	0.13***	0.04	-0.05	0.06**	-0.02	0.10***
	(0.03)	(0.02)	(0.07)	(0.02)	(0.06)	(0.03)
$I(\Delta_3 \text{Rate}_t \geq 0)$		0.05*	-0.01	0.05	-0.04	0.03
		(0.03)	(0.10)	(0.03)	(0.11)	(0.02)
R-Zone $\times$ $I(\Delta_3 \text{Rate} \geq 0)$		0.18***	0.36**	0.19***	0.42***	0.10**
		(0.05)	(0.15)	(0.06)	(0.16)	(0.05)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID			14.52		11.24	
Observations	1351	1351	1351	1351	1351	1351

- But only if rates were cut before entering R-zone ▸ Pre-cut RZ

Combination of U-MP & R-zone is crucial for banking crises

- Sort data by U-MP (over $t-8$ to t) and R-zone ($t-3$ to t)
- Compute crisis frequency for 3 years after each shape (t to $t+2$)

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
U-shaped MP & R-zone	0.36*** (18/49)	0.25*** (12/49)	0.37*** (12/33)	0.30*** (10/33)
U-shaped MP & no R-zone	0.10 (11/118)	0.07 (8/118)	0.06 (3/58)	0.04 (2/58)
No U-shaped MP & R-zone	0.11 (10/98)	0.05 (5/98)	0.06 (4/71)	0.01 (1/71)
No U-shaped MP & no R-zone	0.05 (19/364)	0.03 (10/364)	0.02 (4/220)	0.00 (0/220)
Unconditional	0.09 (58/628)	0.06 (36/628)	0.06 (24/382)	0.03 (13/382)

*: higher frequency than other bins

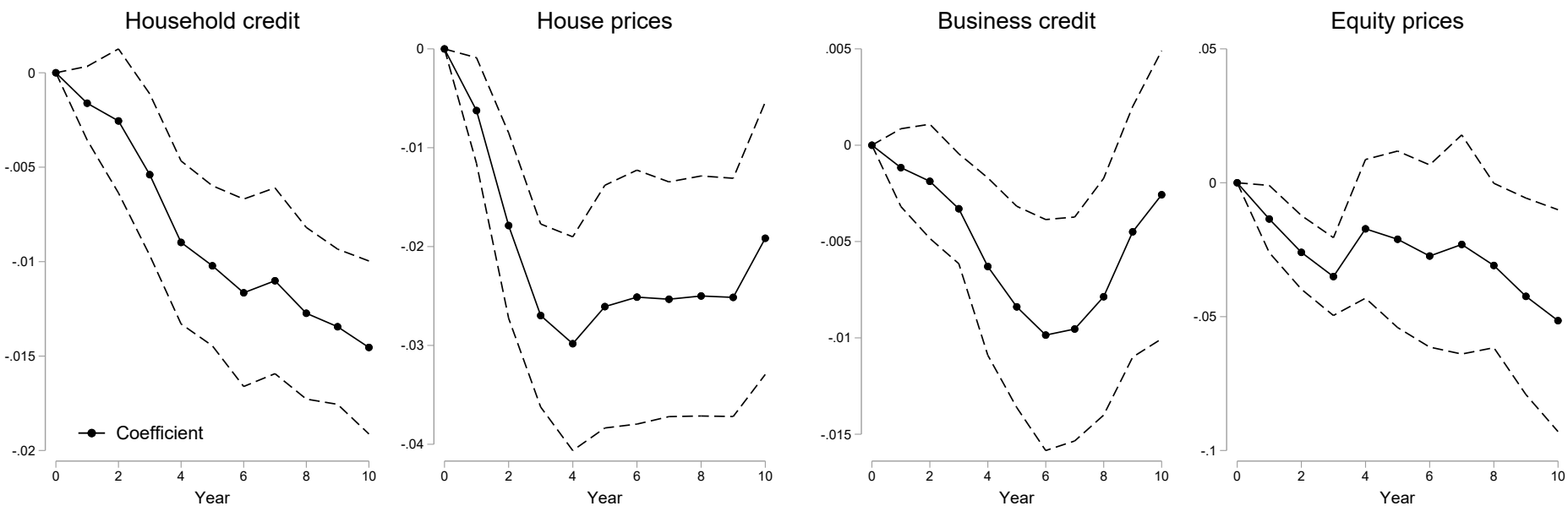
▸ Residual U & R-zones ▸ Broader R-zone window

Why is the combination of U & R-zone conducive to crises?

- Raising rates in the R-zone reverses the vulnerabilities that built up during the low-rate period
  - Does raising rates trigger a larger decline in credit, house prices, etc. the larger the previous growth in credit, house prices, ...?
- Raising rates after long periods of cuts puts stress on the banking system
  - What is the impact of U-shaped policy rates on banking sector returns & profits?

Reversal in pre-existing vulnerabilities

$$\Delta_h y_{i,t+h} = \alpha_{i,h} + \alpha_{d,h} + \beta_{1,h}\Delta \text{Rate}_{i,t} + \beta_{2,h} I(\Delta_3 y_{i,t} \geq \text{Rz}) +$$
$$\beta_{3,h}\Delta \text{Rate}_{i,t} \times I(\Delta_3 y_{i,t} \geq \text{Rz}) + \sum_{L=0}^{L=5} \gamma_L X_{i,t-L} + \epsilon_{i,t+h}$$



- Raising rates when, e.g., house prices are elevated, results in larger future drops in house prices ▸ IV

U-shaped MP & banking sector outcomes

- U-shape in MP rates leads to declines in bank profitability, increasing loan losses, lower bank stock returns

▸ Bank equity crises

	$\Delta \text{RoE}_{t \text{ to } t+2}$		$\Delta \text{NPL}_{t \text{ to } t+2}$		$\text{Return}^{\text{Bank}}_{t \text{ to } t+2}$	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 \text{Rate}_t$	-0.12	-0.01	0.05**	0.13***	-0.02	0.02
	(0.15)	(0.33)	(0.02)	(0.04)	(0.01)	(0.02)
$\text{Cut Rate}_{t-8,t-3}$	0.17	0.43	0.03	-0.04	-0.04	-0.06
	(0.70)	(0.65)	(0.09)	(0.07)	(0.05)	(0.05)
$\Delta_3 \text{Rate}_t \times \text{Cut Rate}_{t-8,t-3}$	-0.83***	-3.16***	0.09***	0.27***	-0.03*	-0.07*
	(0.26)	(1.04)	(0.03)	(0.09)	(0.02)	(0.04)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID		30.49		16.51		17.91
Observations	1563	1350	868	756	1420	1298

Loan-level evidence from the Spanish credit register

Data and specifications

- Sample: all new loans extended by banks to businesses 1995-2008 (robustness: 1995–2016)
- Exogenous monetary policy set in Frankfurt; bank-dominated financial system
- Predict loan default over 3 years:

$$\begin{aligned}\text{Loan Default}_{i,j,t,t+3} = {} & \beta_1 \Delta_3 \text{Rate}_{t,t+3} + \beta_2 \text{Cut}_{t-5,t} \\ & + \beta_3 \Delta_3 \text{Rate}_{t,t+3} \times \text{Cut}_{t-5,t} \\ & + \beta_4 \Delta_3 \text{Rate}_{t,t+3} \times \text{Cut}_{t-5,t} \times \text{F}_{j,t-1} \\ & + \beta_5 \Delta_3 \text{Rate}_{t,t+3} \times \text{Cut}_{t-5,t} \times \text{B}_{j,t-1} \\ & + \gamma_1 \text{F}_{i,t-1} + \gamma_2 \text{B}_{j,t-1} + \gamma_3 \text{M}_t + \ldots + u_{i,j,t,t+1}\end{aligned}$$

F, B, M: firm & bank characteristics, macro controls.

Heterogeneous effects of U-MP on loan defaults

- Effects larger for loans by ex ante riskier banks & to riskier firms

	Dependent variable: Loan default$_{t+1 \text{ to } t+3}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ_3Rate$_{t,t+3}$	0.003***	0.003***	0.001*	0.002**			
	(0.001)	(0.001)	(0.001)	(0.001)			
Cut Rate$_{t-5,t}$	0.008***	0.007***	0.007***	0.007***			
	(0.003)	(0.003)	(0.003)	(0.003)			
Δ_3Rate$_{t,t+3}$ × Cut Rate$_{t-5,t}$	0.004***	0.004***	0.005***	0.005***			
	(0.001)	(0.001)	(0.001)	(0.001)			
Δ_3Rate × Cut × Real estate firm	0.012***			0.012***	0.012***	0.010***	0.011***
	(0.002)			(0.002)	(0.002)	(0.001)	(0.001)
Δ_3Rate × Cut × Firm not audited		0.002*		0.002*	0.002**		
		(0.001)		(0.001)	(0.001)		
Δ_3Rate × Cut × Firm cost of credit						0.002***	0.001***
						(0.000)	(0.000)
Δ_3Rate × Cut × Bank NPL ratio			0.003***	0.003***	0.002***	0.002***	0.002***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ_3Rate × Cut × Bank NPL × Real estate							0.003*
							(0.002)
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm × Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	Yes	Yes	Yes
Firm Controls	No	No	No	No	No	Yes	Yes
Observations	1.1m	1.1m	1.1m	1.1m	1.1m	0.7m	0.7m
R^2	0.552	0.551	0.551	0.552	0.552	0.586	0.586

▸ Summary statistics ▸ Regression w/o heterogeneity

Conclusion

- **U-shaped MP rate path materially increases crisis risk**
  - Raising MP rates increases crisis risk, but only if rates were previously cut over a long period
  - This link appears **unique to banking crises. Different for non-crisis recessions.** Stronger for deeper U.
- Mechanism: build-up of vulnerabilities as MP rates are cut, reversal as rates are raised
  - **Combination of U-MP & financial red zone crucial**
  - Banking sector is key to transmission, with stronger effects for worse firms & banks in microdata
- Bigger-picture implications
  - Effects of policy on crises are path-dependent
  - Policy options if need to raise rates: raise before the red zone; avoid strong raises; use macropru

Appendix

Literature on monetary policy & financial stability

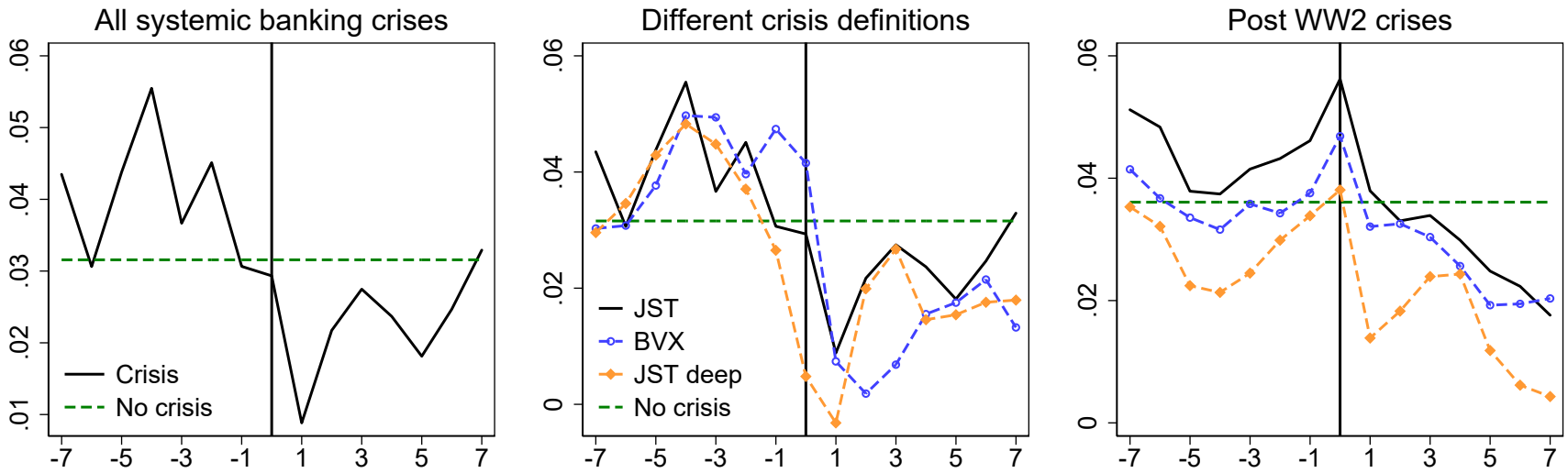
1. Empirical ▸ back
   - Low rates → higher asset prices/credit/risk taking (Rajan, 2006; Adrian and Shin, 2010; Maddaloni and Peydro, 2011; Jiménez et al., 2014; Becker and Ivashina, 2015; Martinez-Miera and Repullo, 2017; Di Maggio and Kacperczyk, 2017; Acharya et al., 2020; Grimm et al., 2023)
   - Link between rate hikes & crises (Schularick, ter Steege, and Ward, 2021)
   - **We show the full MP path matters:** (strong) cuts followed by raises generate financial instability

2. Theoretical
   - Focus on low rates creating financial vulnerability (Stein, 2012; Ajello, Boyarchenko, Gourio, and Tambalotti, 2022)
   - Recent work on combination of loose policy & subsequent tightening as trigger (Diamond and Rajan, 2012; Boissay, Collard, Galí, and Manea, 2021; Acharya, Chauhan, Rajan, and Steffen, 2022)

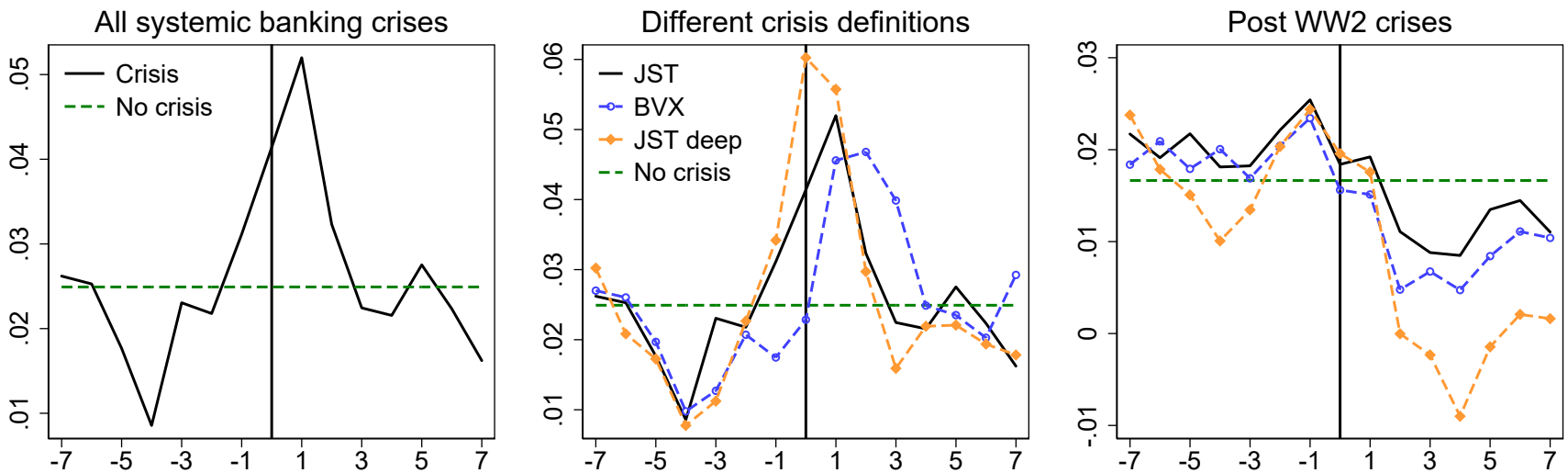
Inflation and real interest rates around crises

back

(a) Inflation:

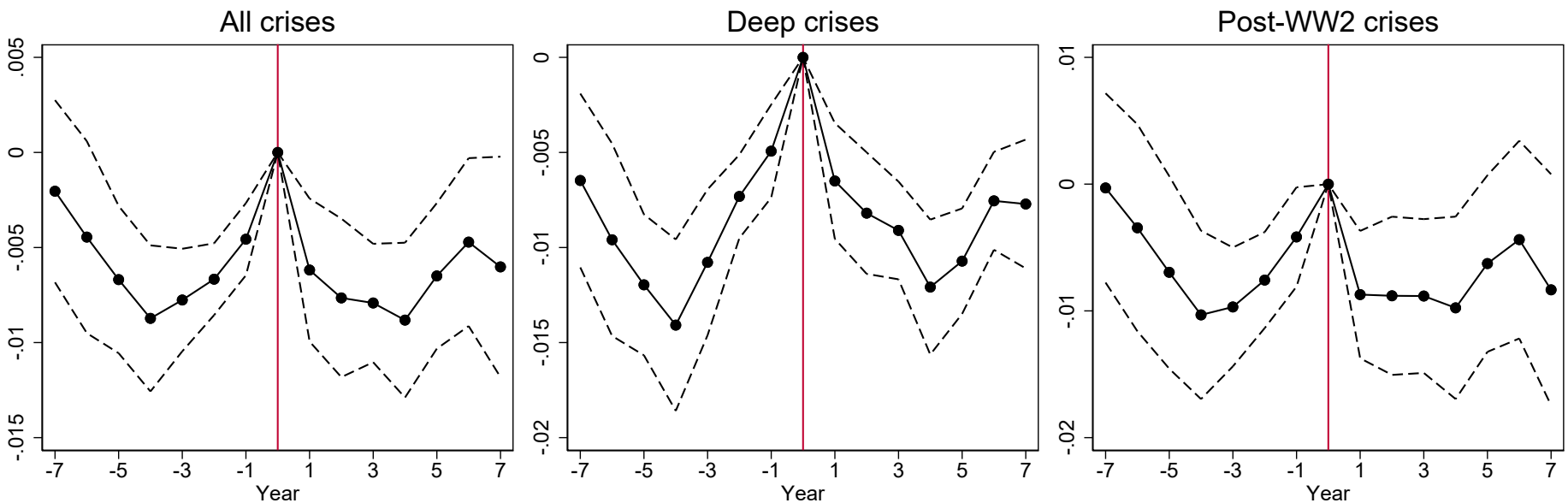


(b) Real interest rates:



Residual interest rates: crisis window regressions

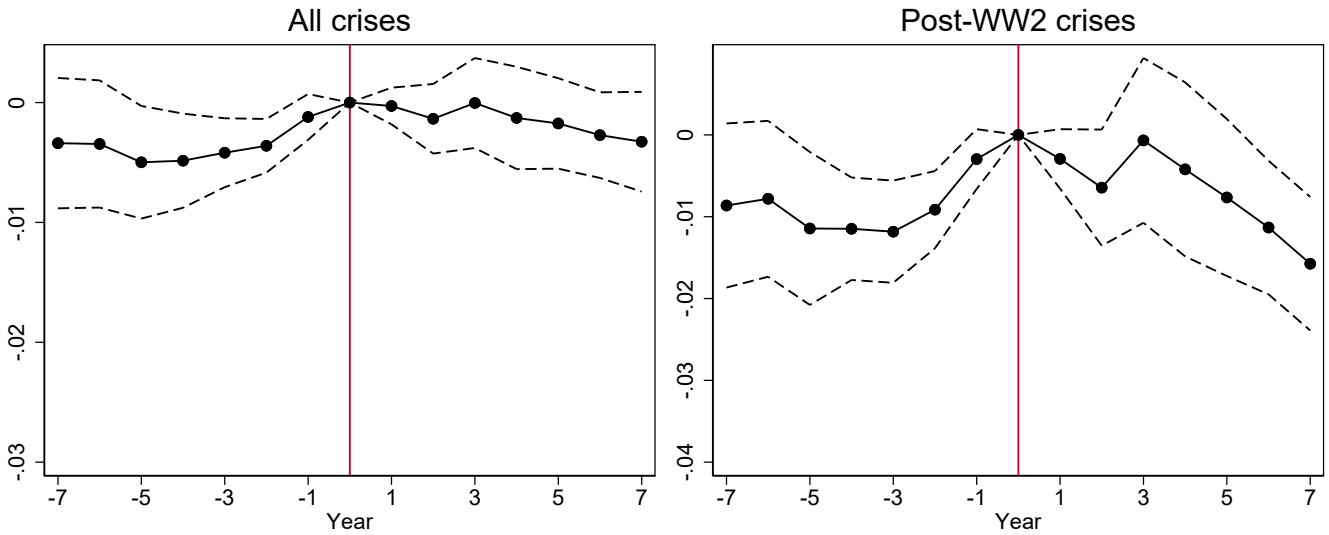
Back



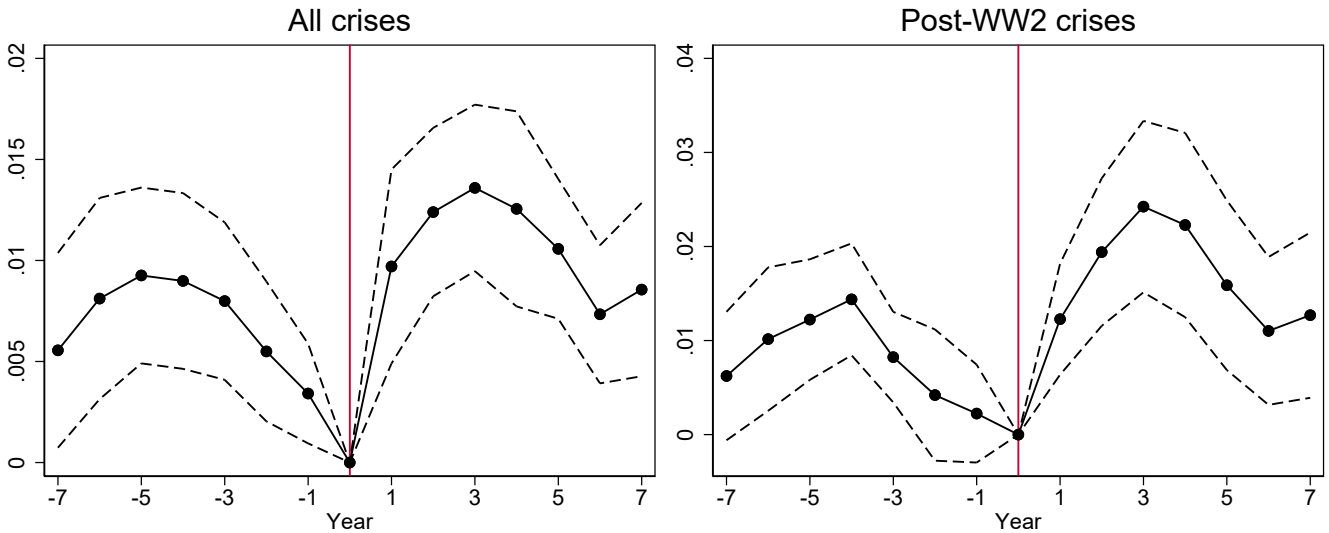
- Residualize changes in MP rates to inflation, GDP, other macro variables, by country & time period

Crisis window regressions: long rates & term premia

(a) Long-term rate around crises:



(b) Term premium (long – short rate):

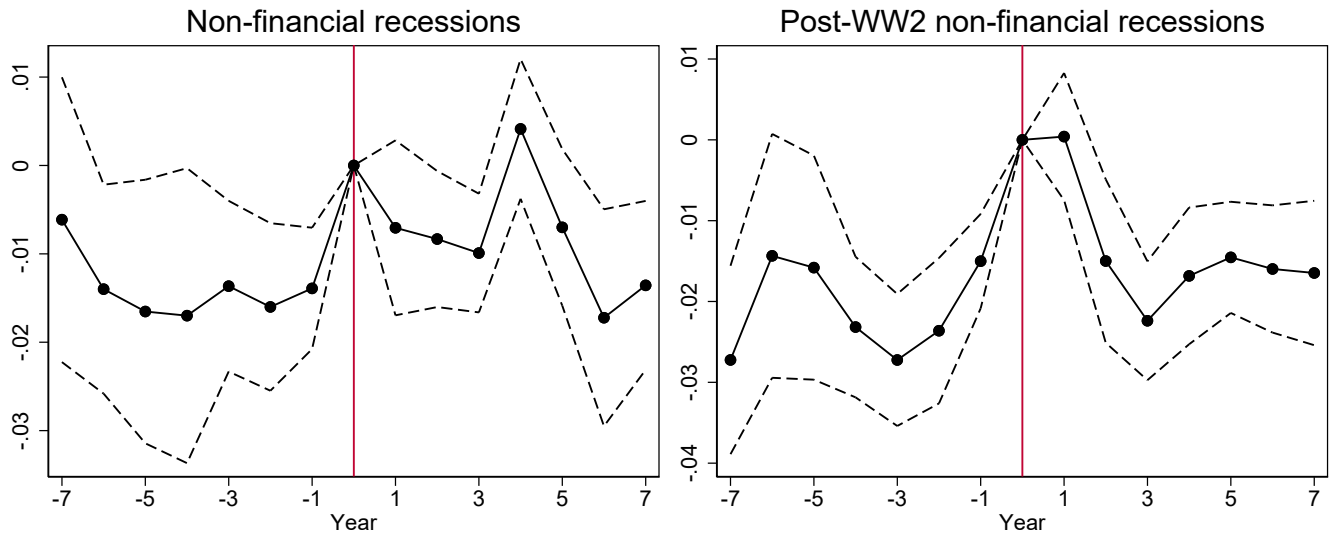


▸ Back

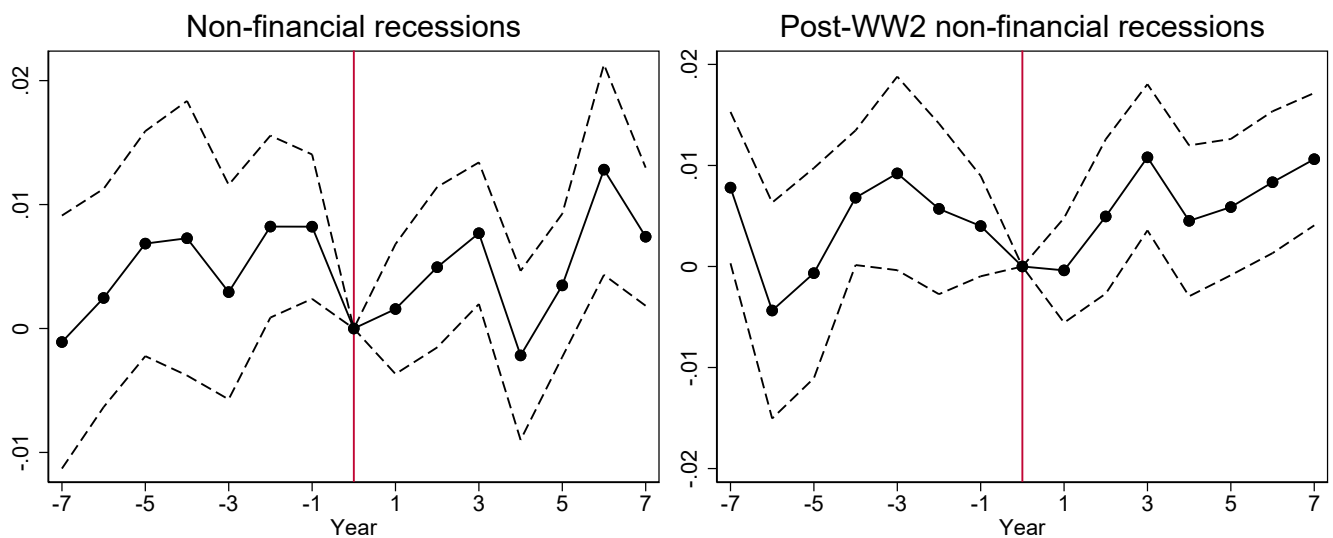
Recession window regressions: real rates & inflation

back

(a) Inflation:



(b) Real interest rate:



Frequency of MP-rate paths before recessions

back

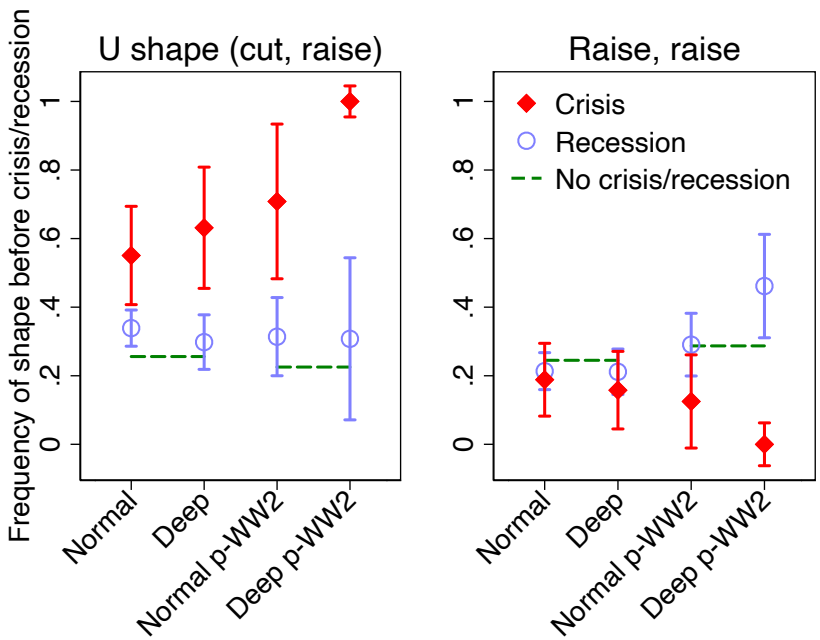
- Only $\approx 30\%$ of non-financial recessions preceded by a U

	(1)	(2)	(3)	(4)	(5)
	Non-crisis recession	Deep non-crisis recession	Post-WW2 non-crisis recession	Post-WW2 deep non-crisis recession	All observations
U shape (cut, raise)	0.34**	0.30	0.31	0.31	0.27
Raise, raise	0.21	0.21	0.29	0.46**	0.24
Raise, cut	0.25	0.21	0.26	0.15	0.26
Cut, cut	0.20	0.28*	0.14	0.08	0.23

Frequency of MP-rate paths before crises and recessions

back

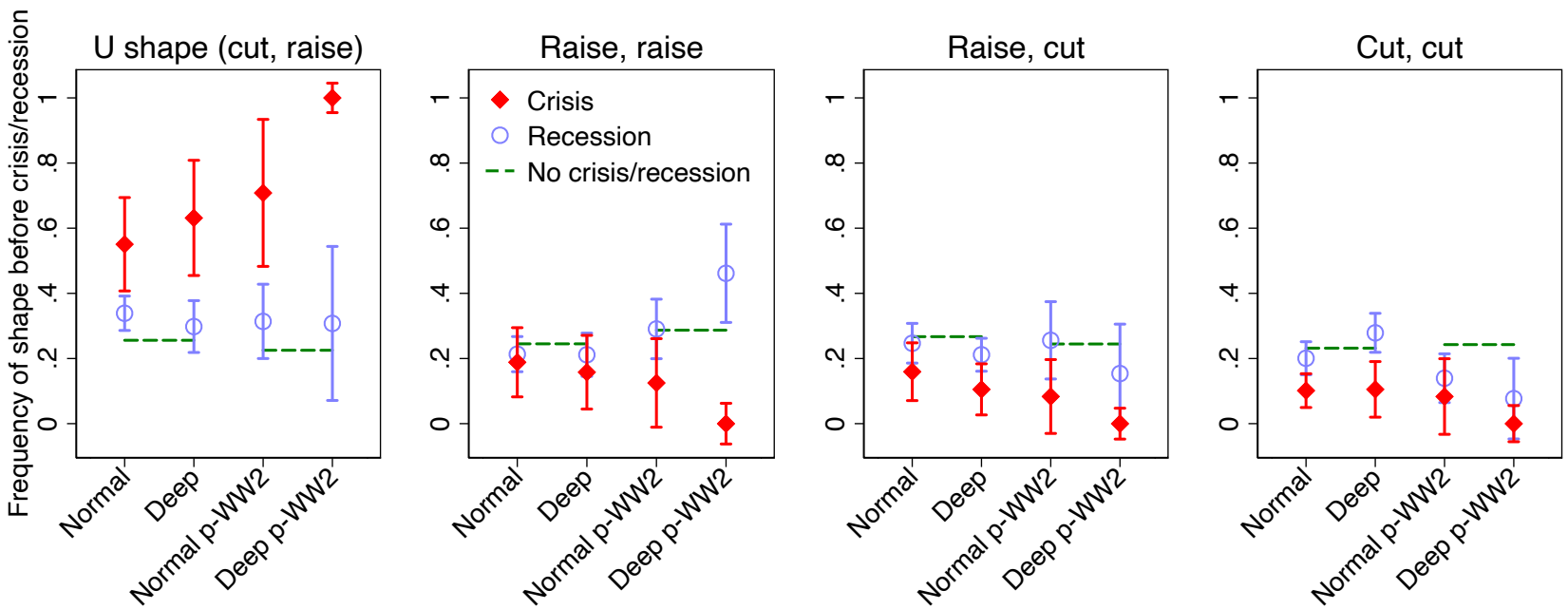
- What is the frequency of the four different policy shapes before crises relative to sample average (and relative to recessions)?
- Red diamonds correspond to previous table / blue circles show frequency of shapes for non-financial recessions



Frequency of MP-rate paths before crises and recessions

back

- What is the frequency of the four different policy shapes before crises relative to sample average (and relative to recessions)?
- Red diamonds correspond to previous table / blue circles show the same for non-financial recessions



Frequency of recessions by policy rate path

Back

- Recession: non-financial business cycle peak in the 3-year window after the policy shape (t to t + 2)
- *: frequency larger than raise-raise (top row), or larger than U (rows 2–4)

	(1)	(2)	(3)	(4)
	Non-crisis recession	Deep non-crisis recession	Post-WW2 non-crisis recession	Post-WW2 deep non-crisis recession
U shape (cut, raise)	0.39*	0.16	0.28	0.04
Raise, raise	0.32	0.14	0.26	0.05
Raise, cut	0.30	0.11	0.20	0.02
Cut, cut	0.28	0.15	0.14	0.02
Unconditional				

Frequency of crises – with numbers of crises

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
U shape (cut, raise)	0.18 (35/196)	0.11 (22/196)	0.16 (15/93)	0.13 (12/93)
Raise, raise	0.09 (15/170)	0.04 (7/170)	0.04 (4/109)	0.01 (1/109)
Raise, cut	0.06 (10/186)	0.02 (4/186)	0.02 (2/93)	0.00 (0/93)
Cut, cut	0.06 (9/164)	0.03 (5/164)	0.03 (2/93)	0.00 (0/93)
Unconditional	0.10 (70/715)	0.05 (39/715)	0.06 (24/388)	0.03 (13/388)

back

Frequency of crises by policy rate path: 1 year ahead crises

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
U shape (cut, raise)	0.06***	0.04**	0.06*	0.05**
Raise, raise	0.03	0.01	0.01	0.00
Raise, cut	0.02	0.01	0.01	0.00
Cut, cut	0.01	0.01	0.01	0.00
Unconditional	0.03	0.02	0.02	0.01

Back

Frequency of crises by policy rate path: symmetric U window (t − 6 to t − 3 and t − 3 to t)

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
U shape (cut, raise)	0.19***	0.11***	0.16***	0.12***
Raise, raise	0.09	0.05	0.03	0.01
Raise, cut	0.06	0.03	0.02	0.00
Cut, cut	0.06	0.03	0.03	0.00
Unconditional	0.10	0.06	0.06	0.03

Back

Paths of inflation, real rates, $r - r^*$, and crisis risk

back

	ΔInflation		ΔReal rate		$r - r^*$ level	
	(1)	(2)	(3)	(4)	(5)	(6)
Var_t	0.001	0.000	0.004*	0.003	0.014**	0.015**
	(0.002)	(0.002)	(0.002)	(0.003)	(0.006)	(0.007)
$1(Var_{t-8,t-3} < 0)$		-0.007		-0.007		0.019
		(0.024)		(0.038)		(0.034)
$Var_t \times 1(Var_{t-8,t-3} < 0)$		0.003		0.002		-0.001
		(0.002)		(0.002)		(0.005)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Observations	1893	1893	1899	1899	1895	1895

U-shaped policy and crises: 1-year changes

back

$$\text{Crisis}_{i,t \text{ to } t+2} = \alpha_i + \beta_1 \Delta\text{Rate}_{i,t} + \beta_2 \text{Cut}_{i,t-8,t-3} + \beta_3 \Delta\text{Rate}_{i,t} \times \text{Cut}_{i,t-8,t-3} + \gamma X_{i,t} + u_{i,t \text{ to } t+2}.$$

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
ΔRate_t	0.02***	0.02***	0.01	0.01	0.02	-0.01
	(0.00)	(0.00)	(0.00)	(0.02)	(0.02)	(0.01)
Cut $\text{Rate}_{t-8,t-3}$		0.08***	0.08***		0.08***	0.08***
		(0.02)	(0.02)		(0.02)	(0.02)
$\Delta\text{Rate}_t \times$ Cut $\text{Rate}_{t-8,t-3}$			0.04***			0.05*
			(0.01)			(0.03)
Country fixed effects	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID				49.52	49.33	16.25
Observations	1673	1673	1673	1673	1673	1673

U-shaped policy and crises: probit

back

	Dependent variable: $\text{Crisis}_{t \text{ to } t+2}$					
	Probit			Probit IV		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 \text{Rate}_t$	0.02***	0.02***	0.01*	0.03**	0.03*	0.00
	(0.00)	(0.00)	(0.01)	(0.01)	(0.02)	(0.02)
$\text{Cut Rate}_{t-8,t-3}$		0.07***	0.06**		0.06**	0.07**
		(0.03)	(0.02)		(0.03)	(0.03)
$\Delta_3 \text{Rate}_t \times \text{Cut Rate}_{t-8,t-3}$			0.02***			0.05**
			(0.00)			(0.03)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID				70.49	75.14	31.80
Observations	1563	1563	1563	1563	1563	1563

U-shaped policy and crises: economic effects

back

Economic effects based on IV estimation in column (6):

- Δ_3Rate: a 1 percentage point 3-year increase in monetary rates is associated with a subsequent 1 percentage point higher crisis probability (insignificant).
- Cuts between t − 8 and t − 3 are associated with a 4% higher crisis probability (insignificant).
- A 1 percentage point 3-year increase in monetary rates following a five-year cut is associated with a subsequent 7 percentage point higher crisis probability.
- A sequence of a cut from t − 8 to t − 3 and then increasing rates by 1 percentage point over three years is associated with a 12 percentage points increase in crisis risk (the sum of the above), more than doubling the crisis probability compared to the sample mean of 10%

Does the depth of the U matter? ▸ back

- More granular analysis of the U
- Sort $\Delta_5 \text{Rate}_{t-3}$ and $\Delta_3 \text{Rate}_t$ both into terciles
- Crisis frequency increases the lower $\Delta_5 \text{Rate}_{t-3}$ and the higher $\Delta_3 \text{Rate}_t$

	Crisis frequency$_{t \text{ to } t+2}$ $\Delta_3 \text{Rate}_{i,t}$			Difference from median $\Delta_3 \text{Rate}_{i,t}$		
$\Delta_5 \text{Rate}_{i,t-3}$	(1) Low	(2) Medium	(3) High	(1) Low	(2) Medium	(3) High
Low	0.08	0.13	0.28	0.03	0.07*	0.22***
Medium	0.06	0.05	0.13	0.00	0.00	0.08
High	0.05	0.08	0.10	-0.01	0.03	0.05

Notes: Left panel: frequency of crises in 9 equal-sized bins of obs, sorted by past 5-year changes and current three-year change in rates. Upper right cell corresponds to U shape. Right panel: Differences relative to Medium-medium bin. Driscoll-Kraay standard errors with 5 lags.

3×3 policy shapes, residual rates

back

	Crisis frequency$_{t \text{ to } t+2}$ $\Delta_3 \text{Rate}_{i,t}$			Difference from median $\Delta_3 \text{Rate}_{i,t}$		
$\Delta_5 \text{Rate}_{i,t-3}$	(1) Low	(2) Medium	(3) High	(1) Low	(2) Medium	(3) High
Low	0.05	0.13	0.24	-0.03	0.04	0.15**
Medium	0.10	0.08	0.12	0.02	0.00	0.04
High	0.07	0.02	0.08	-0.02	-0.06**	-0.01

Notes: Left panel: frequency of crises in 9 equal-sized bins of obs, sorted by past 5-year and current three-year policy rate residuals. Upper right cell corresponds to U shape. Right panel: Differences relative to Medium-medium bin, Driscoll-Kraay standard errors with 5 lags.

Residual vs moderate U, detailed decomposition

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
Strong cut + Strong raise	0.30***	0.21***	0.27***	0.23***
Strong cut + moderate raise	0.00	0.00	0.00	0.00
Moderate cut + Strong raise	0.09	0.09*	0.11	0.11*
Moderate cut + moderate raise	0.00	0.00	0.00	0.00
Raise + raise	0.08	0.03	0.04	0.00
Raise + cut	0.01	0.01	0.01	0.00
Cut + cut	0.05	0.02	0.02	0.00
Unconditional	0.08	0.05	0.06	0.04

Back

Main specification with systematic/residual cuts

back

- Baseline regression with two different dummies for cuts based on residuals.

	Dependent variable: $\text{Crisis}_{t \text{ to } t+2}$					
	All cuts (baseline)		Residual cuts		Systematic cuts	
	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)
$\Delta_3 \text{Rate}_t$	0.01*	0.01	0.01*	0.01	0.02**	0.02
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
$\text{Cut}_{t-8,t-3}$	0.07*	0.06*	0.08**	0.05	0.03	0.03
	(0.04)	(0.04)	(0.03)	(0.03)	(0.05)	(0.05)
$\Delta_3 \text{Rate}_t \times \text{Cut}_{t-8,t-3}$	0.03**	0.07**	0.02***	0.09**	0.02	0.04
	(0.01)	(0.03)	(0.01)	(0.04)	(0.02)	(0.05)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID		28.99		20.87		36.77
Observations	1322	1322	1322	1322	1322	1322

$X_{i,t}$ contains 8 lags of yearly real GDP growth and inflation (country and sample average), and a crisis dummy. Driscoll-Kraay s.e. with 5 lags.

Main specification with residual raises

▸ back

- Residual raises strongly linked to crisis risk.

	Dependent variable: $\text{Crisis}_{t \text{ to } t+2}$				
	All raises (baseline)		Residual raises		Systematic raises
	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)
$\Delta_3 \text{Rate}_t$	0.01*	0.01	-0.01	0.00	0.02**
	(0.01)	(0.02)	(0.01)	(0.03)	(0.01)
$\text{Cut}_{t-8,t-3}$	0.07*	0.06*	0.07*	0.04	0.08*
	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)
$\Delta_3 \text{Rate}_t \times \text{Cut}_{t-8,t-3}$	0.03**	0.07**	0.04**	0.11**	0.01
	(0.01)	(0.03)	(0.02)	(0.05)	(0.01)
Country fixed effects	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID		28.99		11.04	
Observations	1322	1322	1322	1322	1322

$X_{i,t}$ contains 8 lags of yearly real GDP growth and inflation (country and sample average), and a crisis dummy.

Driscoll-Kraay s.e. with 5 lags. ▸ Residual cuts & residual raises

Takeaways ▸ back

- Main results
  - MP rate U shape increases banking crisis risk
  - Different from non-financial recessions
  - Results are stronger for deeper U shape (absolute or relative to what is implied by inflation and GDP)
- Additional results:
  - Holds excluding GFC, across crisis definitions, using probit ▸ Excl. GFC ▸ BVX ▸ Probit
  - Holds controlling for / stronger results than deviations from natural rate ▸ Control for R-R* ▸ U in R-R*

Baron, Verner and Xiong (2021) crises

back

	Full sample - dependent variable: BVX Crisis$_{t \text{ to } t+2}$					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 \text{Rate}_t$	0.02**	0.02**	0.01	0.06***	0.06***	0.04**
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Cut $\text{Rate}_{t-8,t-3}$		0.03	0.03		-0.01	-0.00
		(0.04)	(0.04)		(0.03)	(0.04)
$\Delta_3 \text{Rate}_t \times$ Cut $\text{Rate}_{t-8,t-3}$			0.03**			0.07***
			(0.01)			(0.03)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID				46.39	41.40	25.56
Observations	1626	1626	1626	1626	1626	1626

Excluding GFC in 2007/2008

back

	Pre-2000 sample - dependent variable: $\text{Crisis}_{t \text{ to } t+2}$					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 \text{Rate}_t$	0.01*	0.01*	0.01	0.01	0.01	-0.00
	(0.01)	(0.01)	(0.00)	(0.02)	(0.02)	(0.01)
$\text{Cut Rate}_{t-8,t-3}$		0.03	0.03		0.03	0.03
		(0.02)	(0.02)		(0.03)	(0.03)
$\Delta_3 \text{Rate}_t \times \text{Cut Rate}_{t-8,t-3}$			0.02**			0.05**
			(0.01)			(0.02)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID				40.71	36.98	20.89
Observations	1418	1418	1418	1418	1418	1418

Using average stance over 5-year/3-year window

back

- Low dummy for average stance relative to natural rate over t − 8 to t − 3 (similar results with continuous measure).

	Dependent variable: $\text{Crisis}_{t \text{ to } t+2}$					
	Full sample			Post-1945 sample		
	(1)	(2)	(3)	(4)	(5)	(6)
$(r - r^*)_{t-3,t}$	0.02**	0.02**	0.02**	0.02*	0.02**	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\text{Low}(r - r^*)_{t-8,t-3}$		0.03	0.03		0.03	0.03
		(0.04)	(0.03)		(0.04)	(0.04)
$(r - r^*)_{t-3,t} \times \text{Low}(r - r^*)_{t-8,t-3}$			0.00			0.00
			(0.01)			(0.01)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Observations	1895	1895	1895	1108	1108	1108

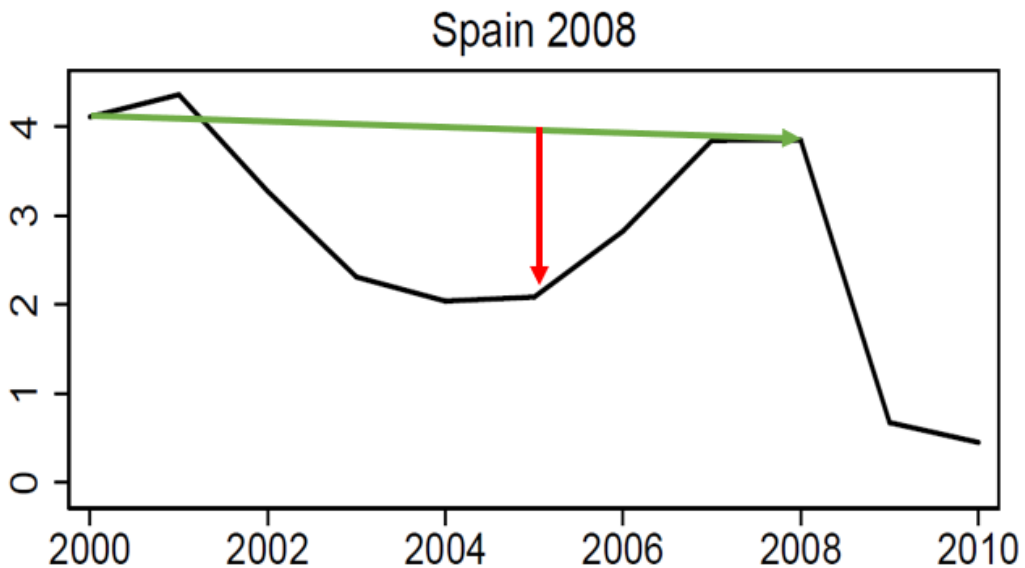
Controlling for stance at t-1 to t-8

back

	Dependent variable: $\text{Crisis}_{t \text{ to } t+2}$					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 \text{Rate}_t$	0.02**	0.02**	0.01**	0.04	0.04	0.02
	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.02)
$\text{Cut Rate}_{t-8,t-3}$		0.09**	0.09*		0.09**	0.07*
		(0.05)	(0.05)		(0.04)	(0.04)
$\Delta_3 \text{Rate}_t \times \text{Cut Rate}_{t-8,t-3}$			0.02**			0.06**
			(0.01)			(0.03)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
8 lags of stance	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID				67.49	65.80	40.34
Observations	1522	1522	1522	1522	1522	1522

U depth

- 8-year window, t = 2008 in this example
- Assume a constant trend (green line) from t – 8 to t
- U dummy: if actual rate (black) below green line at time t – 3
- Deep U dummy: if actual rate more than 1 percentage point below green line (red arrow larger than 1) at time t – 3



Crisis risk and the depth of the U

back

	Dependent variable: $\text{Crisis}_{\text{t to t+2}}$			
	(1)	(2)	(3)	(4)
$\Delta\text{Rate}_{t-8,t}$	0.01**	0.01**	0.01**	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)
$U_{t-8,t-3,t}$	0.07***	0.03*	0.07***	0.04*
	(0.02)	(0.02)	(0.02)	(0.02)
Deep $U_{t-8,t-3,t}$		0.09***		0.07***
		(0.02)		(0.02)
Country fixed effects	✓	✓	✓	✓
Controls	✓	✓	✓	✓
Observations	1903	1903	1835	1835

Main specification with residual cuts and raises

- Baseline regression with two different dummies for cuts based on residuals. Back

	Dependent variable: $\text{Crisis}_{t \text{ to } t+2}$				
	All raises (baseline)		Residual raises		Systematic raises
	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)
$\Delta_3 \text{Rate}_t$	0.01*	0.01	-0.01	0.01	0.02***
	(0.01)	(0.02)	(0.01)	(0.03)	(0.01)
Residual $\text{Cut}_{t-8,t-3}$	0.08**	0.05	0.08***	-0.02	0.11***
	(0.03)	(0.03)	(0.03)	(0.06)	(0.04)
$\Delta_3 \text{Rate}_t \times$ Residual $\text{Cut}_{t-8,t-3}$	0.02***	0.09**	0.05***	0.15*	-0.00
	(0.01)	(0.04)	(0.01)	(0.08)	(0.01)
Country fixed effects	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID		20.87		5.38	
Observations	1322	1322	1322	1322	1322

$X_{i,t}$ contains 8 lags of yearly real GDP growth and inflation (country and sample average), and a crisis dummy. Driscoll-Kraay s.e. with 5 lags.

LP set up

$$\Delta_h y_{i,t+h} = \alpha_{i,h} + \alpha_{d,h} + \beta_h \Delta \text{Rate}_{i,t} + \sum_{L=0}^{L=4} \gamma_L X_{i,t-L} + \epsilon_{i,t+h}, \quad h \in \{1, ..., 5\}.$$

- $\Delta_h y_{i,t+h}$ is the change in credit or asset prices
- Controls: credit, asset prices, GDP, inflation (contemporaneous + 4 lags); interest rates (4 lags)
- We reverse the sign on ΔRate

▸ back

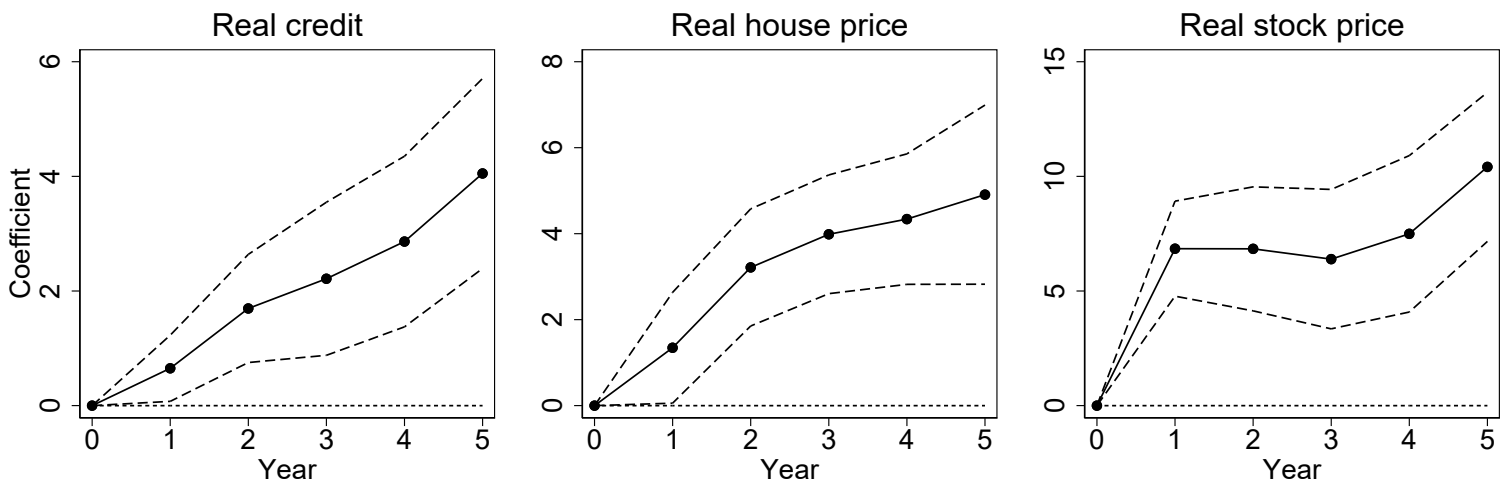
Boom: credit & AP response to rate cuts

back

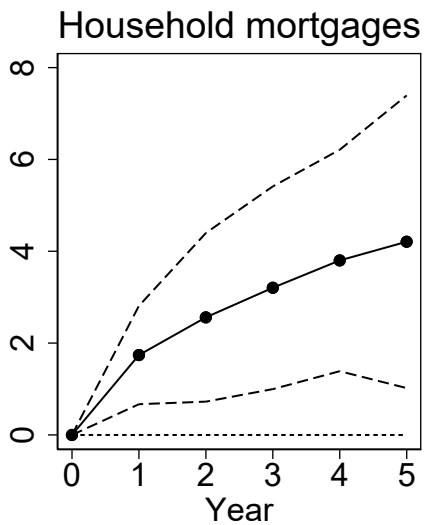
$$\Delta_h y_{i,t+h} = \alpha_{i,h} + \alpha_{d,h} + \beta_h \Delta \text{Rate}_{i,t} + \sum_{L=0}^{L=4} \gamma_L X_{i,t-L} + \epsilon_{i,t+h}, \quad h \in \{1, ..., 5\}.$$

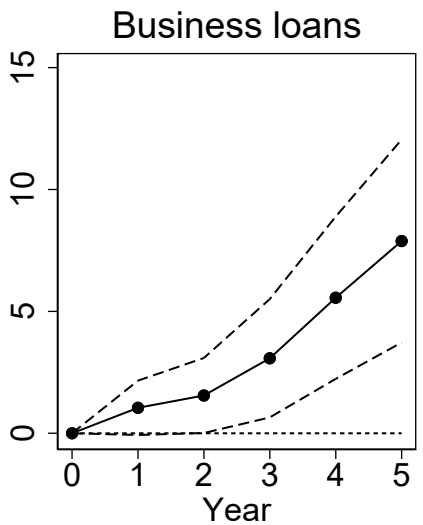
(a) Raw:

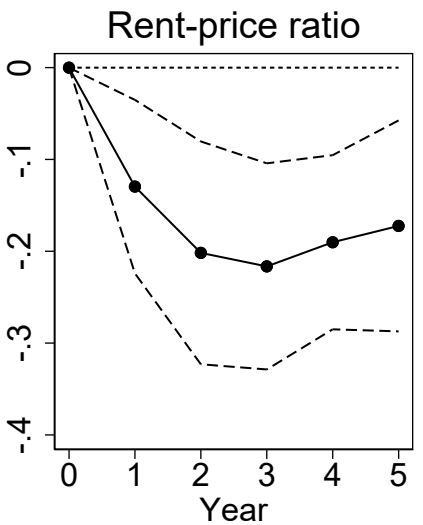
(b) Instrumented:

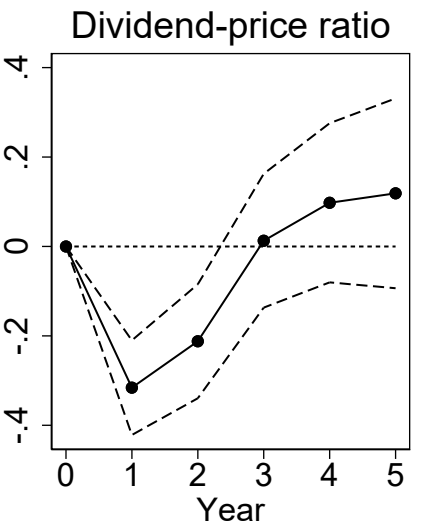


Boom: Types of loans and risk premia









back

Rate cuts increase the likelihood of future R-zones

back

- Monetary rate cuts increase the likelihood of ending up in the R-zone over the next 3 years

	R-Zone Either$_{t+1 \text{ to } t+3}$							
	ΔRate$_{t-5,t}$		Cut Rate$_{t-5,t}$		ΔResidual Rate$_{t-5,t}$		Exc. Cut Rate$_{t-5,t}$	
	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
See header	-0.02***	-0.05***	0.07**	0.34**	-0.02***	-0.06**	0.05	0.36**
	(0.01)	(0.02)	(0.04)	(0.15)	(0.01)	(0.03)	(0.03)	(0.17)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap		43.48		54.67		57.52		33.85
Observations	1335	1335	1335	1335	1247	1247	1247	1247

What are the mechanisms linking MP-cuts & R-zones?

▸ back

- Credit expansions with low spreads & poor outcomes
  - MP cuts $\Rightarrow \uparrow$ likelihood of low-spread credit boom ($\geq$ 80th pctile credit growth & below-country-mean spreads) ▸ low-spread booms
  - Low-spread credit booms are not associated with better outcomes (loan losses, RoE, crises) ▸ outcomes
- Rising valuations of bank stocks & stable capital ratios
  - Boom-bust in bank returns & sentiment around pre-cut R-zones, larger than for non-financials ▸ stock returns
  - Flat capital ratios
- Consistent with $\uparrow$ credit supply & overoptimism

Rate cuts and low-spread credit expansions

back

	Dependent variable: Credit boom$_{t+1 \text{ to } t+3}$							
	Low-spread credit boom				High-spread credit boom			
	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
ΔRate$_{t-5,t}$	-1.06*	-6.33***			0.30	0.27		
	(0.58)	(2.38)			(1.09)	(1.86)		
Cut Rate$_{t-5,t}$			0.08**	0.51**			0.05	-0.02
			(0.04)	(0.24)			(0.04)	(0.15)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓
KP Weak ID		50.83		15.50		41.35		17.32
Observations	540	488	540	488	540	488	540	488

- MP rate cuts ↑ likelihood of a low-spread credit boom ($\geq$ 80th pctile credit growth & below-country-mean spreads)

Low-spread credit expansions and subsequent outcomes

back

Dependent variable:	$\text{Crisis}_{t \text{ to } t+2}$		$\Delta\ \text{RoE}_{t \text{ to } t+2}$		$\Delta\ \text{LoL}_{t \text{ to } t+2}$	
	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
$\text{Credit boom}_{t-3 \text{ to } t-1}$	0.16**	0.07**	-5.48***	-1.65*	0.45***	0.31**
	(0.06)	(0.03)	(1.51)	(0.93)	(0.11)	(0.14)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Observations	660	660	622	622	482	482

- Low-spread boom $\Rightarrow$ higher crisis risk, lower RoE, higher loan losses; more so than for high-spread booms

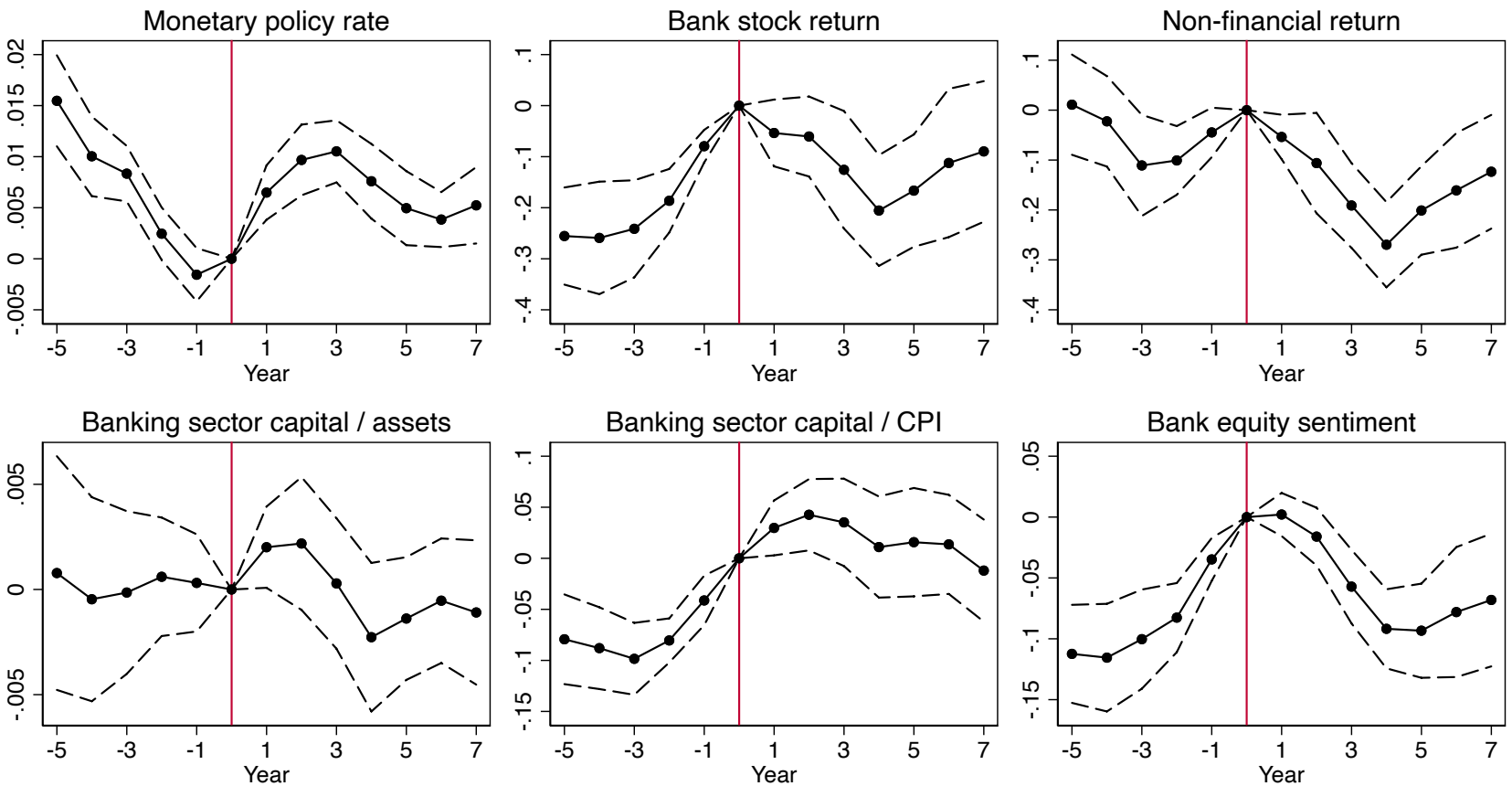
Bank & non-fin. returns around pre-cut R-zones

back

$$y_{i,t+h} - y_{i,t} = \alpha_{i,h} + \alpha_{d,h} + \beta_h \mathbb{1}_{\text{Enter Pre-cut R-zone}_{i,t}=1} + \epsilon_{i,t+h}$$

- Conditional on entering pre-cut R-zone at t = 0: bank (specific) stock boom, elevated sentiment (predictably low bank stock returns), flat capital ratios

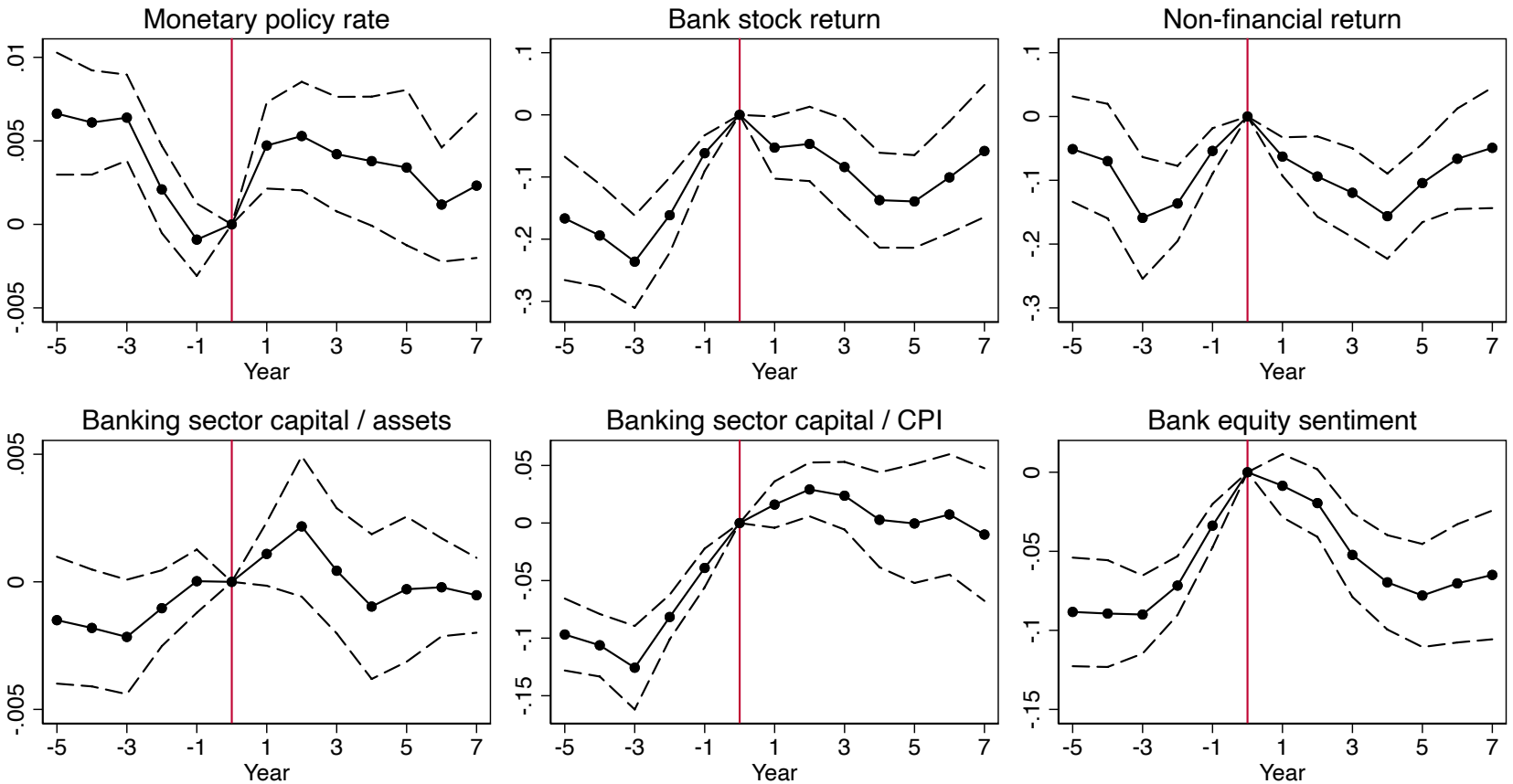
All r-zones



Bank & non-fin. returns around all R-zones

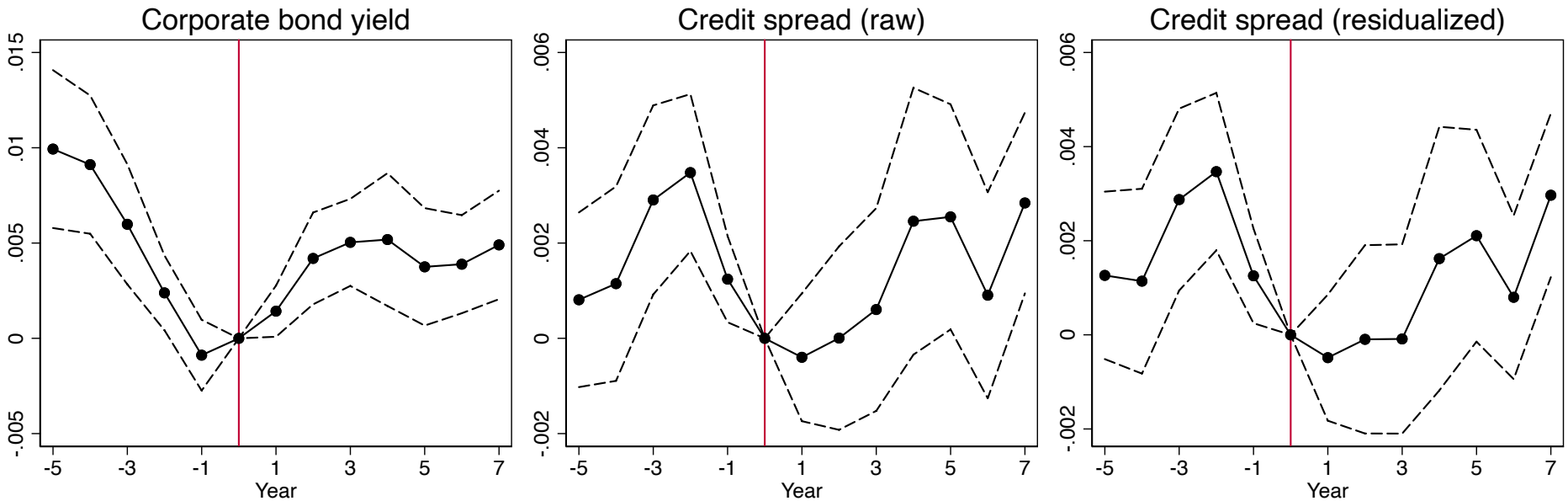
back

$$y_{i,t+h} - y_{i,t} = \alpha_{i,h} + \alpha_{d,h} + \beta_h \mathbb{1}_{\text{Enter R-zone}_{i,t}=1} + \epsilon_{i,t+h}$$



Corporate bond spreads around pre-cut R-zones

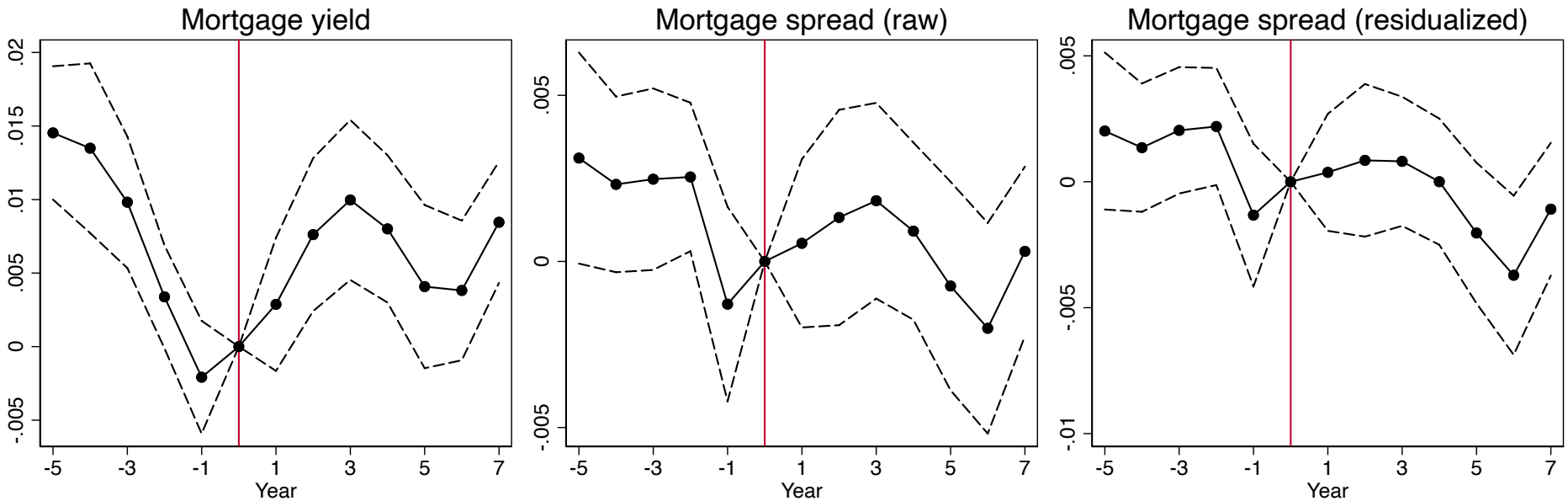
back



- Falling spreads & cost of credit when credit & asset prices are growing (t = -3 to 0)

Mortgage spreads around pre-cut R-zones

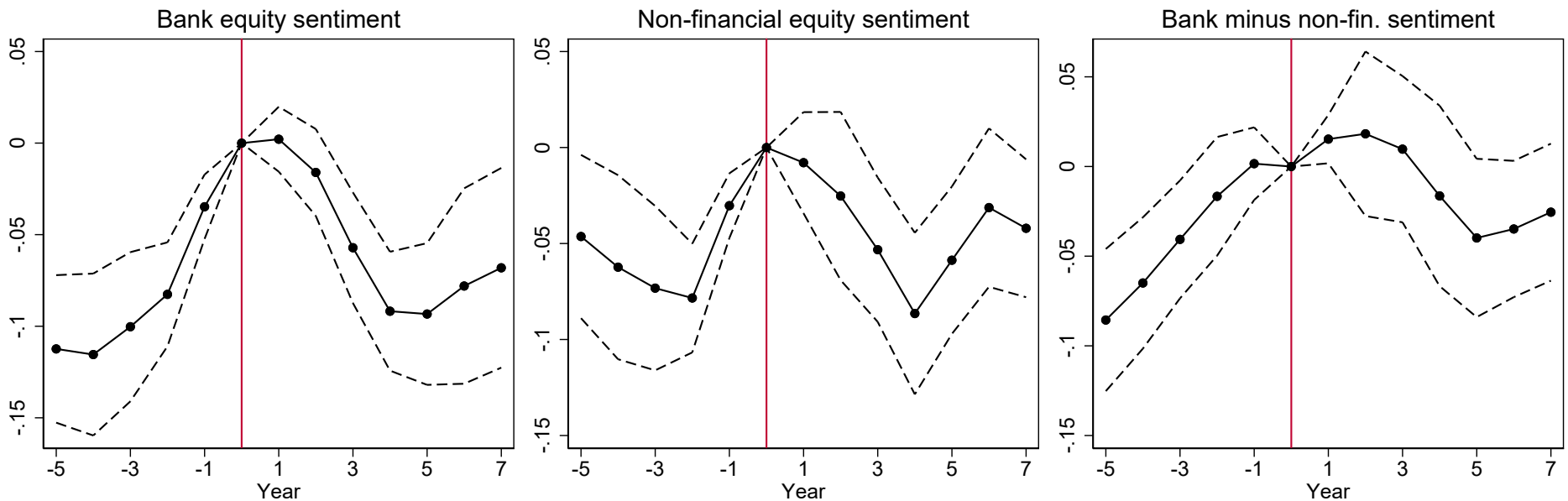
back



- Falling spreads & cost of credit when credit & asset prices are growing (t = -3 to 0)

Bank & non-financial sentiment around pre-cut R-zones

back



- Higher sentiment in R-zone, reversal after, especially for banks

Does monetary policy before the R-zone matter when raising? back

- Raising rates in R-zone increases crisis risk only if the R-zone was preceded by a rate cut

	Dependent variable: $\text{Crisis}_{t \text{ to } t+2}$								
	R-zone			R-zone, pre cut			R-zone, pre raise		
	OLS		IV	OLS		IV	OLS		IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\text{R-Zone}_{t-3 \text{ to } t-1}$	0.12***	0.04*	-0.08	0.17***	0.06*	-0.03	0.01	-0.01	-0.08
	(0.02)	(0.02)	(0.08)	(0.04)	(0.03)	(0.10)	(0.04)	(0.02)	(0.12)
$I(\Delta_3 \text{Rate}_t \geq 0)$		0.05**	-0.10		0.06**	-0.07		0.10***	0.04
		(0.02)	(0.07)		(0.02)	(0.08)		(0.02)	(0.08)
$\text{R-Zone}_{t-3 \text{ to } t-1} \times I(\Delta_3 \text{Rate}_t \geq 0)$		0.16***	0.41**		0.20***	0.41**		0.04	0.19
		(0.05)	(0.17)		(0.07)	(0.20)		(0.08)	(0.27)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID			21.14			17.36			2.71
Observations	1474	1474	1474	1474	1474	1474	1474	1474	1474

MP rates in the R zone and crisis frequencies

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
Raise in R-zone	0.26 (11/42)	0.19 (8/42)	0.26 (9/35)	0.20 (7/35)
Cut in R-zone	0.06 (2/36)	0.00 (0/36)	0.04 (1/27)	0.00 (0/27)
Raise outside of R-zone	0.10 (23/233)	0.05 (12/233)	0.04 (6/135)	0.02 (3/135)
Cut outside of R-zone	0.04 (13/325)	0.02 (8/325)	0.02 (3/187)	0.00 (0/187)
Unconditional	0.08 (49/636)	0.04 (28/636)	0.05 (19/383)	0.03 (10/383)

back

Raising rates in the R-zone – continuous raises

	Dependent variable: $\text{Crisis}_{t \text{ to } t+2}$					
	All raises			Residual raises		Systematic raises
	OLS (1)	OLS (2)	IV (3)	OLS (4)	IV (5)	OLS (6)
$\text{R-Zone}_{t-3 \text{ to } t-1}$	0.13***	0.13***	0.13***	0.13***	0.12***	0.13***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
$\Delta_3 \text{Rate}_t$		0.01	0.01	-0.00	0.00	0.01***
		(0.01)	(0.02)	(0.01)	(0.02)	(0.00)
R-Zone $\times$ Δ_3Rate		0.03***	0.05**	0.03**	0.09*	0.02***
		(0.01)	(0.02)	(0.02)	(0.05)	(0.01)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID			13.89		13.72	
Observations	1351	1351	1351	1351	1351	1351

▸ Back

MP rates before the R zone & crisis frequencies

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
R-zone preceded by cut	0.29 (15/52)	0.19 (10/52)	0.29 (12/41)	0.19 (8/41)
R-zone preceded by raise	0.04 (1/27)	0.00 (0/27)	0.05 (1/21)	0.00 (0/21)
Cut not followed by R-zone	0.09 (23/269)	0.06 (16/269)	0.05 (7/148)	0.03 (5/148)
Raise not followed by R-zone	0.07 (19/283)	0.04 (12/283)	0.02 (3/173)	0.00 (0/173)
Unconditional	0.09 (58/631)	0.06 (38/631)	0.06 (23/383)	0.03 (13/383)

back

Residual U-MP & R-zone combination crucial

back

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
Residual U-MP & R-zone	0.46*** (14/31)	0.32*** (10/31)	0.43*** (10/23)	0.35*** (8/23)
Systematic U-MP & R-zone	0.20 (3/13)	0.12 (2/13)	0.23* (2/10)	0.17* (2/10)
U-shaped MP & no R-zone	0.09 (7/79)	0.07 (5/79)	0.07 (3/46)	0.05 (2/46)
No U-shaped MP & R-zone	0.10 (8/81)	0.05 (4/81)	0.06 (4/68)	0.01 (1/68)
No U-shaped MP & no R-zone	0.04 (11/264)	0.03 (7/264)	0.02 (4/187)	0.00 (0/187)
Unconditional	0.09 (44/469)	0.06 (27/469)	0.07 (24/334)	0.04 (13/334)

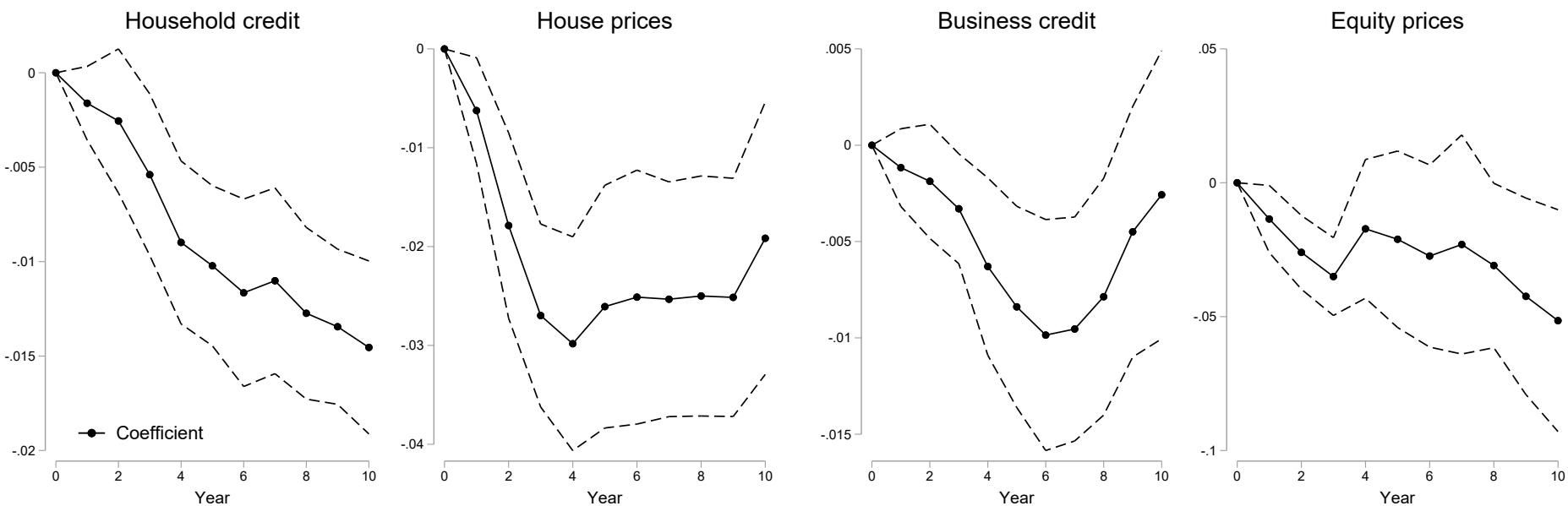
Crisis frequencies: U-MP & R zone alternative timing t − 5 to t

	(1)	(2)	(3)	(4)
	Crisis	Deep crisis	Post-WW2 crisis	Post-WW2 deep crisis
U-shaped MP & R-zone	0.32 (19/60)	0.21 (13/60)	0.32 (13/40)	0.25 (10/40)
U-shaped MP & no R-zone	0.09 (10/107)	0.07 (8/107)	0.05 (3/51)	0.04 (2/51)
No U-shaped MP & R-zone	0.09 (14/148)	0.05 (8/148)	0.05 (5/103)	0.01 (1/103)
No U-shaped MP & no R-zone	0.05 (15/319)	0.03 (8/319)	0.02 (4/188)	0.00 (0/188)
Unconditional	0.09 (58/633)	0.06 (36/633)	0.06 (24/382)	0.03 (13/382)

back

Reversal in pre-existing vulnerabilities

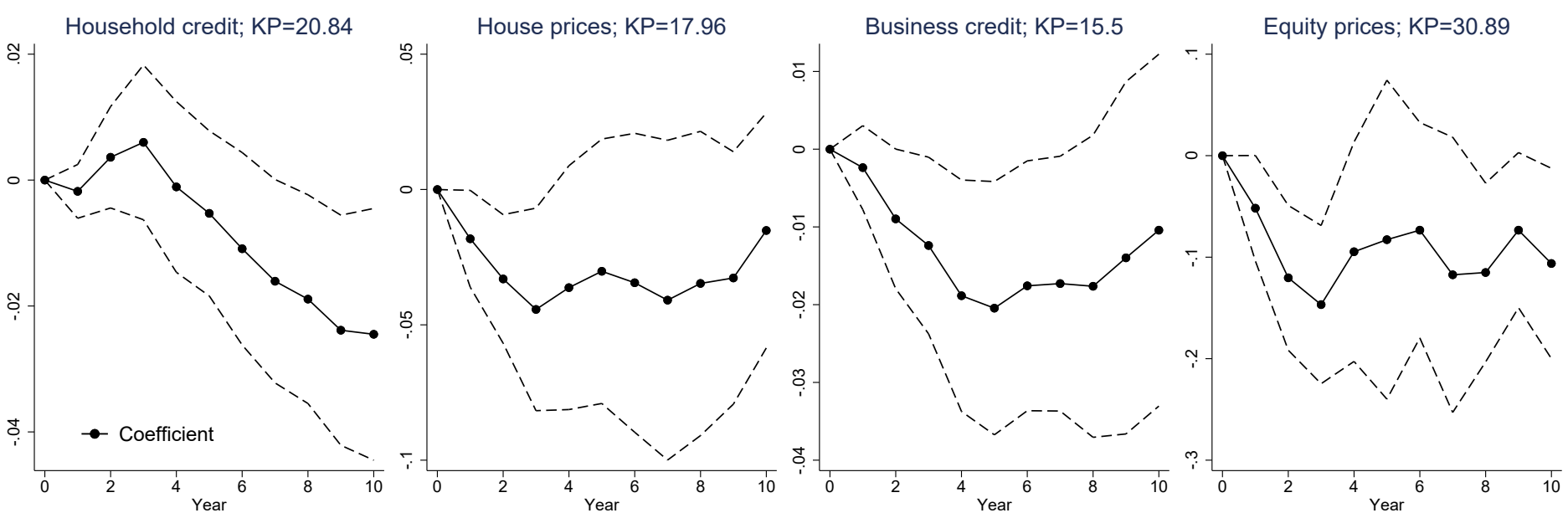
$$\Delta_h y_{i,t+h} = \alpha_{i,h} + \alpha_{d,h} + \beta_{1,h}\Delta \text{Rate}_{i,t} + \beta_{2,h} I(\Delta_3 y_{i,t} \geq \text{Rz}) +$$
$$\beta_{3,h}\Delta \text{Rate}_{i,t} \times I(\Delta_3 y_{i,t} \geq \text{Rz}) + \sum_{L=0}^{L=5} \gamma_L X_{i,t-L} + \epsilon_{i,t+h}$$



- Raising rates when, e.g., house prices are elevated, results in larger future drops in house prices ▸ IV

Reversal in pre-existing vulnerabilities – IV

back



Policy rate path and the risk of bank equity crises

back

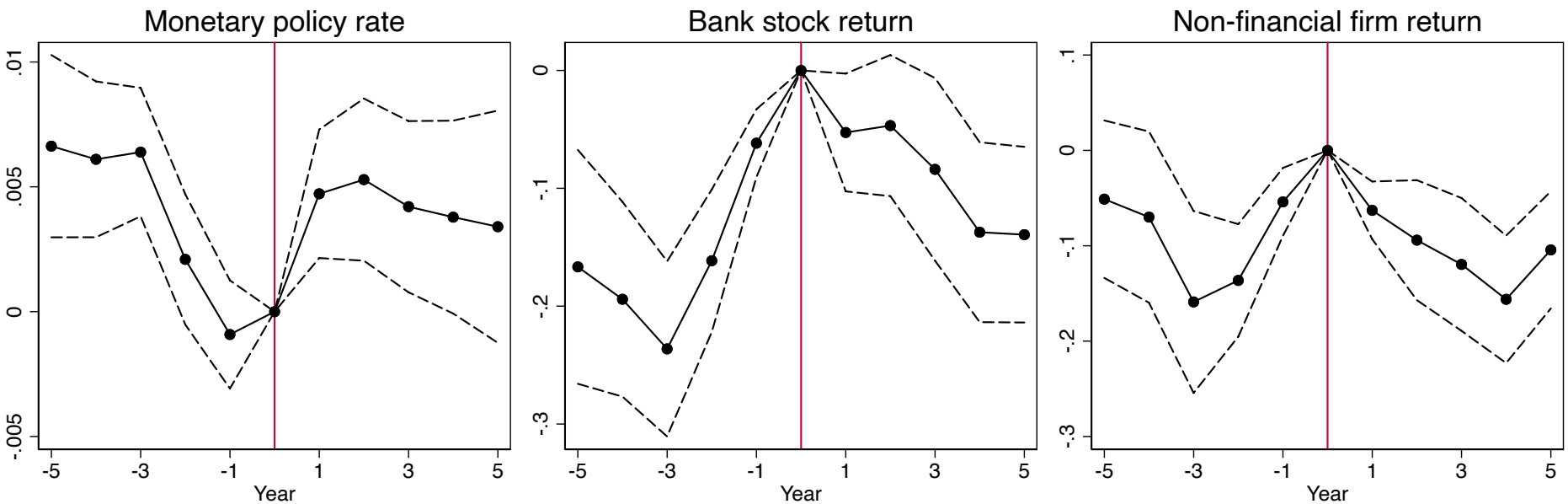
- Dependent variable: dummy = 1 if cumulative bank stock return $\leq -30\%$ (Baron et al., 2021)

	Dependent variable: Bank equity crisis$_{t \text{ to } t+2}$					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 \text{Rate}_t$	0.01***	0.01***	0.00	0.02**	0.02**	-0.00
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Cut $\text{Rate}_{t-8,t-3}$		0.04**	0.04**		0.03**	0.04**
		(0.02)	(0.02)		(0.02)	(0.02)
$\Delta_3 \text{Rate}_t \times$ Cut $\text{Rate}_{t-8,t-3}$			0.02***			0.06**
			(0.01)			(0.03)
Country fixed effects	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID				81.57	83.26	36.60
Observations	1624	1624	1624	1624	1624	1624

Bank & non-fin. returns & MP rates around all R-zones

back

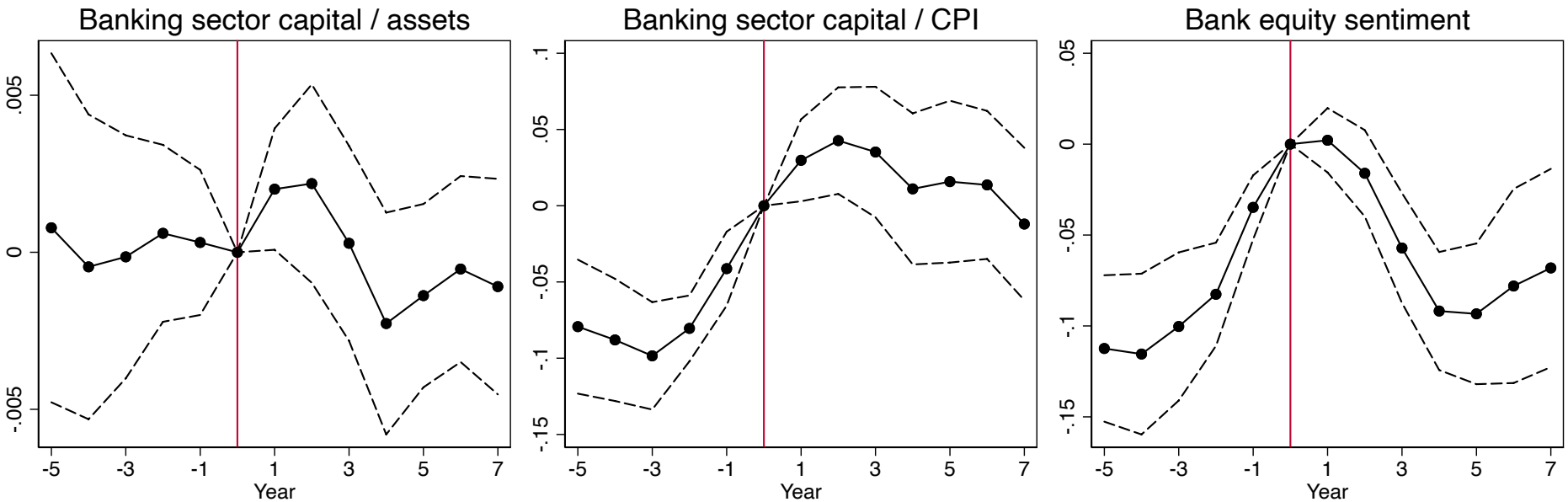
$$y_{i,t+h} - y_{i,t} = \alpha_{i,h} + \alpha_{d,h} + \beta_h \mathbb{1}_{\text{Enter R-zone}_{i,t}=1} + \epsilon_{i,t+h}$$



Bank capital and bank equity sentiment around R-zones

back

$$y_{i,t+h} - y_{i,t} = \alpha_{i,h} + \alpha_{d,h} + \beta_h \mathbb{1}_{\text{Enter pre-cut R-zone}_{i,t}=1} + \epsilon_{i,t+h}$$



- Bank equity market sentiment: (minus) predictable component of bank stock return (using past credit growth & price-dividend ratios, see Baron and Xiong, 2017; López-Salido et al., 2017)
- High sentiment means predictably low future returns

Administrative data: summary statistics

back

		Mean (1)	S.D. (2)	P25 (3)	Median (4)	P75 (5)
Loan default$_{t,t+1}$	0/1	0.019	0.135	0.000	0.000	0.000
ΔRate$_{t,t+1}$	%	-0.326	1.093	-0.906	-0.143	0.245
Cut Rate$_{t-5,t}$	0/1	0.427	0.495	0.000	0.000	1.000
Short maturity	0/1	0.503	0.500	0.000	1.000	1.000
Firm bad credit history	0/1	0.109	0.311	0.000	0.000	0.000
Construction & real estate firm	0/1	0.214	0.410	0.000	0.000	0.000
Firm not in Mercantile Register the previous year	0/1	0.246	0.431	0.000	0.000	0.000
Firm average cost of credit	%	3.190	2.801	1.052	2.597	4.610
Bank NPL Ratio	0.0x	0.043	0.051	0.008	0.017	0.061

Monetary policy path & loan-level defaults in Spain

back

- Loans extended when rates were cut have much higher default rates when rates are raised

	Dependent variable: Loan default$_{t+1 \text{ to } t+3}$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Delta_3 \text{Rate}_{t,t+3}$	0.001*	0.000	0.000	0.002**	0.001	0.002**	0.001	0.002*	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Cut $\text{Rate}_{t-5,t}$	0.012***	0.010***	0.010***	0.006***	0.007***	0.007**	0.007***	0.007***	0.012***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$\Delta_3 \text{Rate}_{t,t+3} \times \text{Cut Rate}_{t-5,t}$		0.003**	0.004***	0.003***	0.003***	0.002**	0.003***	0.004***	0.007***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Industry × Location FE	No	No	Yes	Yes	-	Yes	-	-	-
Bank Controls	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	No	No	No	No	Yes	Yes	-	-
Firm FE	No	No	No	No	Yes	No	Yes	-	-
Firm × Bank FE	No	No	No	No	No	No	No	Yes	Yes
Firm Controls	No	No	No	No	No	No	No	No	Yes
Observations	1.1m	1.1m	1.1m	1.1m	1.1m	1.1m	1.1m	1.1m	0.7m
R^2	0.031	0.031	0.220	0.220	0.353	0.221	0.354	0.551	0.584

Monetary policy path & loan-level defaults in Spain – demeaned variables

▸ back

	Dependent variable: Loan default$_{t+1 \text{ to } t+3}$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ_3 Rate$_{t,t+3}$	0.001*	0.001**	0.002***	0.003***	0.003***	0.003***	0.003***	0.003***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Cut Rate$_{t-5,t}$	0.012***	0.010***	0.011***	0.007***	0.007***	0.007**	0.008***	0.008***	0.014***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Δ_3 Rate$_{t,t+3}$ × Cut Rate$_{t-5,t}$		0.003**	0.004***	0.003**	0.003***	0.002**	0.003***	0.004***	0.007***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Industry × Location FE	No	No	Yes	Yes	-	Yes	-	-	-
Bank Controls	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	No	No	No	No	Yes	Yes	-	-
Firm FE	No	No	No	No	Yes	No	Yes	-	-
Firm × Bank FE	No	No	No	No	No	No	No	Yes	Yes
Firm Controls	No	No	No	No	No	No	No	No	Yes
Observations	1.1m	1.1m	1.1m	1.1m	1.1m	1.1m	1.1m	1.1m	0.7m
R^2	0.031	0.031	0.220	0.220	0.353	0.221	0.354	0.551	0.584

Monetary policy path & loan-level defaults in Spain – full 1995–2020 sample

back

	Dependent variable: Loan default$_{t+1 \text{ to } t+3}$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ_3Rate$_{t,t+3}$	0.005***	0.005***	0.004***	0.005***	0.003*	0.005***	0.005***	0.005***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Cut Rate$_{t-5,t}$	0.007***	0.006***	0.009***	0.006***	0.009***	0.005**	0.008***	0.008***	0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Δ_3Rate$_{t,t+3}$ × Cut Rate$_{t-5,t}$		0.000	0.002	0.002*	0.004**	0.002**	0.003**	0.004**	0.003**
		(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Industry × Location FE	No	No	Yes	Yes	-	Yes	-	-	-
Bank Controls	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	No	No	No	No	Yes	Yes	-	-
Firm FE	No	No	No	No	Yes	No	Yes	-	-
Firm × Bank FE	No	No	No	No	No	No	No	Yes	Yes
Firm Controls	No	No	No	No	No	No	No	No	Yes
Observations	1.6m	1.6m	1.6m	1.6m	1.6m	1.6m	1.6m	1.6m	1.1m
R^2	0.038	0.038	0.220	0.220	0.353	0.221	0.354	0.551	0.526

Heterogeneous effects: full sample

back

	Dependent variable: Loan default$_{t+1 \text{ to } t+3}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ_3Rate$_{t,t+3}$	0.006***	0.007***	0.007***	0.007***			
	(0.001)	(0.001)	(0.001)	(0.001)			
Cut Rate$_{t-5,t}$	0.008***	0.008***	0.008***	0.009***			
	(0.003)	(0.003)	(0.003)	(0.003)			
Δ_3Rate$_{t,t+3}$ × Cut Rate$_{t-5,t}$	0.003**	0.005**	0.004**	0.005**			
	(0.001)	(0.002)	(0.001)	(0.002)			
Δ_3Rate × Cut × Real estate firm	0.007**			0.007**	0.007**	0.004	0.001
	(0.003)			(0.003)	(0.003)	(0.003)	(0.009)
Δ_3Rate × Cut × Firm not audited			0.003**	0.001	0.001		
			(0.001)	(0.001)	(0.001)		
Δ_3Rate × Cut × Firm cost of credit						0.002***	0.002***
						(0.000)	(0.000)
Δ_3Rate × Cut × Bank NPL ratio		0.001		0.001*	0.001	0.001	0.001
		(0.001)		(0.001)	(0.001)	(0.001)	(0.001)
Δ_3Rate × Cut × Bank NPL × Real estate							-0.002
							(0.003)
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm × Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	Yes	Yes	Yes
Firm Controls	No	No	No	No	No	Yes	Yes
Observations	1.6m	1.6m	1.6m	1.6m	1.6m	1.1m	1.1m
R-squared	0.497	0.496	0.497	0.500	0.500	0.528	0.530

U-shaped policy and defaults: economic effects

back

- A 1 percentage point change in the monetary interest rate after loan origination increases the 3-year probability of loan delinquency by 7.4% in relative terms (given that the average default probability equals 4.5 percentage points).
- The probability of loan delinquency increases by 17.1% if monetary rates were cut around loan origination (from the coefficient on the Cut dummy).
- A 1 percentage point increase in the monetary policy rate after periods of declining policy rates raises the probability of loan default by 8.1%.
- Summing together the coefficients, the probability of delinquency increases by 32.6% if at origination, the Cut dummy is one, and monetary rates increase by 1 percentage point over the following three years.